

Consortium Agreement

for

ReSEAlience

1 October 2025

Based on DESCA – Model Consortium Agreement for Horizon Europe

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This Consortium Agreement (“**CA**”) takes effect on 2025-07-01, hereinafter referred to as the “**Effective Date**”, and has been entered into by and between

BETWEEN:

LULEÅ UNIVERSITY OF TECHNOLOGY, LTU, Universitetsområdet Porsön, 971 87 Luleå, Sweden, (“**Coordinator**”)

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hereinafter jointly or individually, referred to as “**Parties**” or “**Party**”,

relating to the project entitled: *Unlocking the Potential of Seaweeds and Halophytes through Biorefinery for Enhanced Resilience in the Aquaculture Agri-Food and Chemical Industries*, in short: *ReSEAlence*, hereinafter referred to as the “**Project**”.

WHEREAS:

The Parties, having considerable experience in the field concerned, have submitted a proposal for the Project to the Second Joint Co-funded Call for transnational research projects on "Unified Paths to Climate-Neutral, Sustainable, and Resilient Blue Economy: Engaging Civil Society, Academia, Policy, and Industry and having been awarded public grants for a Project under the Sustainable Blue Economy Partnership (SBEP) program from several National Funding Agencies.

The Parties wish to specify binding commitments among themselves with regard to the implementation of the Project.

The Parties are aware that this CA is based upon the [DESCA model consortium agreement](#).

NOW, THEREFORE, IT IS HEREBY AGREED AS FOLLOWS:

1 Definitions

Words beginning with a capital letter shall have the meaning defined in this CA.

“Access Rights” means rights to use Results or Background under the terms and conditions laid down in this CA.

“Background” means any data, know-how or information — whatever its form or nature (tangible or intangible), including any rights such as intellectual property rights — that (i) is held by a Party before they acceded to the CA, and (ii) is Needed to implement the Project or Exploit the Results.

“Confidential Information” means all information which is disclosed by a Party (**“Disclosing Party”**) in writing to any other Party (**“Recipient”**) in connection with the Project during its implementation and which has been explicitly marked as “confidential”, or similar, at the time of disclosure, or, when disclosed orally or visually, has been identified as confidential at the time of disclosure and has been confirmed and designated in writing within 15 calendar days from oral disclosure at the latest as confidential information by the Disclosing Party.

“Defaulting Party” means a Party which the General Assembly has declared to be in breach of this CA and/or the Parties individual Grant Agreement, as specified in Section 4.3 of this CA.

“Exploitation” or **“Exploit”** means the use of Results in further research, teaching and innovation activities other than those covered by the Project, including also but not limited to commercial exploitation such as developing, creating, manufacturing and marketing a product or process, creating and providing a service or in standardisation activities.

“Fair and Reasonable conditions” means appropriate conditions, including possible financial terms or royalty-free conditions, taking into account the specific circumstances of the request for Access Rights, for example the actual or potential value of the Results or Background to which Access Rights are requested and/or the scope, duration or other characteristics of the Exploitation envisaged.

“Force Majeure” means any situation or event that (i) prevents a Party from fulfilling their obligations under the CA, (ii) was unforeseeable, exceptional situation and beyond the Party’s control, (iii) was not due to error or negligence on their part (or on the part of third parties involved in the Project), and (iv) proves to be inevitable in spite of exercising all due diligence. For the avoidance of doubt, the following cannot be invoked as force majeure: (i) any default of a service, defect in equipment or material or delays in making them available, unless they stem directly from a relevant case of force majeure, (ii) labour disputes or strikes, or (iii) financial difficulties. It shall also include any unforeseeable restriction resulting from import or export laws and regulations and/or an unforeseeable delay of the granting or extension of the import or export license or other governmental authorisation provided that the relevant Party has filled a complete application for these necessary export licenses and/or governmental authorisations in time.

“Grant Agreement” means the agreement entered into by the respective Party and its National Funding Agency, setting out the terms and conditions for the funding from the respective National Funding Agency.

“National Funding Agencies” means the national funding agencies which have awarded funding for individual Parties subject to their respective Grant Agreements. The National Funding Agencies are listed in Attachment 1.

“Needed” means

For the implementation of the Project: Access Rights are Needed if, without the grant of such Access Rights, carrying out the tasks assigned to the recipient Party would be technically or legally impossible, significantly delayed, or require significant additional financial or human resources.

For Exploitation of own Results: Access Rights are Needed if, without the grant of such Access Rights, the Exploitation of own Results would be technically or legally impossible.

“Project Plan” means the description of the Project including the related budget as first laid down in the proposal for the Project to the Second Joint Co-funded Call. The Project Plan is set out in Attachment 2.

“Publication” means academic publication, presentation or other public release of a Result or other information arising in the Project.

“Result” means any (tangible or intangible) output of the Project such as data, knowledge or information — whatever its form or nature, whether it can be protected or not — that is generated in the Project, as well as any rights attached to it, including intellectual property rights.

“Software” means sequences of instructions to carry out a process in, or convertible into, a form executable by a computer and fixed in any tangible medium of expression.

2 Entry into force, duration and termination

2.1 Entry into force

An entity becomes a Party to this CA upon signature of this CA by a duly authorised representative.

This CA shall have effect from the Effective Date identified at the beginning of this CA.

An entity becomes a new Party to the CA upon signature of the accession document (Attachment 4) by the new Party and the Coordinator. Such accession shall have effect from the date identified in the accession document.

2.2 Duration and termination

This CA shall continue in full force and effect until complete fulfilment of all obligations undertaken by the Parties in the Project and under this CA. However, this CA or the participation of one or more Parties to it may be terminated in accordance with the terms of this CA.

2.3 Survival of rights and obligations

The provisions relating to Access Rights, dissemination and confidentiality, for the time period mentioned therein, as well as for inspection of National Funding Agencies, liability, applicable law and settlement of disputes and any other provisions that by their nature are meant to survive termination of this CA, shall survive the expiration or termination of this CA.

Termination shall not affect any rights or obligations of a Party leaving the consortium incurred prior to the date of termination, unless otherwise agreed between the General Assembly and the leaving Party. This includes the obligation to provide all necessary input, deliverables and documents for the period of its participation.

3 Responsibilities of Parties

3.1 General principles

Each Party undertakes to take part in the efficient implementation of the Project, and to cooperate, perform and fulfil, promptly and on time, all of its obligations under this CA and as specified for its funding by its National Funding Agency, as may be reasonably required from it and in a manner of good faith as prescribed by Swedish law.

Each Party shall implement its tasks and submit information and reports in accordance with the Project Plan and the requirements set by National Funding Agencies or by the Sustainable Blue Economy Partnership. Each Party shall bear sole responsibility for ensuring that its acts within the Project do not knowingly infringe applicable law or third party property rights.

Each Party represents, warrants and is responsible to ensure that the provisions of this CA are not in conflict with the terms and conditions for funding laid down for the funding awarded by its respective National Funding Agency. The other Parties shall be exempted from any liability and shall be held harmless from any claim in connection to any conflict or discrepancies between this CA and the terms and conditions laid down by the respective National Funding Agency. The Parties confirm that they have received or will shortly receive a copy of their agreements with the National Funding Agencies, and are familiar with its content, particularly the limitations in connection with the maximum state aid intensity.

Each Party undertakes to notify the Coordinator promptly, in accordance with the governance structure of the Project, about any significant information, fact, problem or delay likely to affect the Project. In case of significant delay the Parties shall jointly, through the General Assembly, address and decide on any necessary revision of the Project Plan, including the division of tasks and timelines. The Parties shall cooperate in case such amendments entail a request for prolongation to be made to the National Funding Agencies.

A Party shall immediately notify the Coordinator in the event that any person or company acquires decisive direct or indirect control of one or more of the Parties by acquiring shares, through agreements or in any other manner.

Each Party shall promptly provide all information reasonably required by the General Assembly or by the Coordinator to carry out its tasks and for any Party to fulfil its obligations towards a National Funding Agency.

Each Party shall take reasonable measures to ensure the accuracy of any information or materials it supplies to the other Parties.

The Parties shall, throughout the Project and for a period of at least five (5) years after its termination through the submission of final reports to the National Funding Agencies by the Parties, reasonably produce and provide all relevant documentation and information at the request of a National Funding Agency or to any of its appointed inspectors.

3.2 Breach

In the event that the General Assembly identifies a breach by a Party of its obligations under this CA (e.g. improper implementation of the Project), the Coordinator or, if the Coordinator is in breach of its obligations, the Party appointed by the General Assembly, will give formal notice to such Party requiring that such breach will be remedied within 30 calendar days from the date of receipt of the written notice by the Party.

If such breach is substantial and is not remedied within that period or is not capable of remedy, the General Assembly may decide to declare the Party to be a Defaulting Party and to decide on the consequences thereof which may include termination of its participation.

3.3 Involvement of third parties

A Party that enters into a subcontract or otherwise involves third parties (including any affiliated entities) in the Project remains responsible for carrying out its relevant part of the Project and for such third party's compliance with the provisions of this CA and of the respective Grant Agreement. Such Party has to ensure that the involvement of third parties does not affect the rights and obligations of the other Parties under this CA.

3.4 Specific responsibilities regarding data protection

Where necessary, the Parties shall cooperate in order to enable one another to fulfil legal obligations arising under applicable data protection laws (the *Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data* and relevant national data protection law applicable to said Party) within the scope of the performance and administration of the Project and of this CA.

In particular, the Parties shall, where necessary, conclude a separate data processing, data sharing and/or joint controller agreement before any data processing or data sharing takes place.

4 Liability towards each other

4.1 No warranties

In respect of any information or materials (incl. Results and Background) supplied by one Party to another under the Project, no warranty or representation of any kind is made, given or implied as to the sufficiency or fitness for purpose nor as to the absence of any infringement of any proprietary rights of third parties.

Therefore,

- the recipient Party shall in all cases be entirely and solely liable for the use to which it puts such information and materials, and
- no Party granting Access Rights shall be liable in case of infringement of proprietary rights of a third party resulting from any other Party exercising its Access Rights.

4.2 Limitations of contractual liability

No Party shall be responsible to any other Party for any indirect or consequential loss or similar damage such as, but not limited to, loss of profit, loss of revenue or loss of contracts, provided such damage was not caused by a wilful act of gross negligence.

For any remaining contractual liability, a Party's aggregate liability towards the other Parties collectively shall be limited to the Party's share of the total costs of the Project as identified in the Project Plan, i.e. the funding provided to it by its National Funding Agency, provided such damage was not caused by a wilful act or gross negligence.

The terms of this CA shall not be construed to amend or limit any Party's statutory liability.

4.3 Damage caused to third parties

Each Party shall be solely liable for any loss, damage or injury to third parties resulting from the performance of the said Party's obligations by it or on its behalf under this CA or from its use of Results or Background.

4.4 Force Majeure

No Party shall be considered to be in breach of this CA if it is prevented from fulfilling its obligations under the CA by Force Majeure.

Each Party will notify the General Assembly of any Force Majeure without undue delay. If the consequences of Force Majeure for the Project are not overcome within 6 weeks after such notice, the transfer of tasks - if any - shall be decided by the General Assembly.

4.5 Export control

No Party shall be considered to be in breach of this CA if it is prevented from fulfilling its obligations under the CA due to a restriction resulting from import or export laws and regulations and/or any delay of the granting or extension of the import or export license or any other governmental authorisation, provided that the Party has used its reasonable efforts to fulfil its tasks and to apply for any necessary license or authorisation properly and in time.

Each Party will notify the General Assembly of any such restriction without undue delay. If the consequences of such restriction for the Project are not overcome within 6 weeks after such notice, the transfer of tasks - if any - shall be decided by the General Assembly.

5 Governance structure

5.1 General structure

The organisational structure of the consortium shall comprise the General Assembly and the Coordinator.

5.2 General Assembly

5.2.1 Members

The General Assembly shall consist of one representative of each Party (hereinafter referred to as "**Member**").

Each Member shall be deemed to be duly authorised to deliberate, negotiate and decide on all matters listed in Section 5.2.2.7 of this CA.

The Coordinator shall chair all meetings, unless decided otherwise by the General Assembly.

The Parties agree to abide by all decisions of the General Assembly.

This does not prevent the Parties from exercising their veto rights, according to Section 5.2.2.5, or from submitting a dispute for resolution in accordance with the provisions of settlement of disputes in Section 10.8 of this CA.

5.2.2 Operational procedures

5.2.2.1 Representation in meetings

Any Member:

- should be present or represented at any meeting;
- may appoint a substitute or a proxy to attend and vote at any meeting; and
- shall participate in a cooperative manner in the meetings.

5.2.2.2 Preparation and organisation of meetings

The chairperson shall convene ordinary meetings at least once every six months and shall also convene extraordinary meetings at any time upon written request of any Member.

The chairperson shall give written notice of a meeting together with an agenda to each Member as soon as possible and no later than 14 calendar days preceding an ordinary meeting and 7 calendar days preceding an extraordinary meeting.

Any agenda item requiring a decision by the Members must be identified as such on the agenda. Any Member may add an item to the original agenda by written notice to all of the other Members no later than 7 calendar days preceding an ordinary meeting and 2 days preceding an extraordinary meeting. During a meeting the Members present or represented can unanimously agree to add a new item to the original agenda.

Meetings may also be held by tele- or videoconference or other telecommunication means.

Decisions will only be binding once the relevant part of the minutes has been accepted according to Section 5.2.2.6.

5.2.2.3 Decisions without a meeting

Any decision may also be taken without a meeting if

- a) the Coordinator circulates to all Members a suggested decision with a deadline for responses of at least 10 calendar days after receipt by a Party and
- b) the decision is agreed by no less than 51 % of all Members.

The Coordinator shall inform all the Members of the outcome of the vote.

The decision will be binding after the Coordinator sends a second notification to all Members following the expiration of the veto period. The Coordinator will keep records of the votes and make them available to the Parties on request.

5.2.2.4 Voting rules and quorum

The General Assembly shall not deliberate and decide validly in meetings unless two-thirds (2/3) of its Members are present or represented (quorum).

If the quorum is not reached, the chairperson shall convene another ordinary meeting within 15 calendar days. If in this meeting the quorum is not reached once more, the chairperson shall convene an extraordinary meeting which shall be entitled to decide even if less than the quorum of Members is present or represented.

Each Member present or represented in the meeting shall have one vote.

A Party which the General Assembly has declared according to Section 3.2 to be a Defaulting Party may not vote.

Decisions shall be taken by a majority of two-thirds (2/3) of the votes cast.

5.2.2.5 Veto rights

A Party which can show that its own work, time for performance, costs, liabilities, intellectual property rights or other legitimate interests would be severely affected by a decision of the General Assembly may exercise a veto with respect to the corresponding decision or relevant part of the decision.

When the decision is foreseen on the original agenda, a Party may only veto such a decision during the meeting.

When a decision has been taken on a new item added to the agenda before or during the meeting, a Party may veto such decision during the meeting or within 15 calendar days after receipt of the draft minutes of the meeting.

When a decision has been taken without a meeting a Party may veto such decision within 15 calendar days after receipt of the written notice by the chairperson of the outcome of the vote.

In case of exercise of veto, the Parties shall make every effort to resolve the matter which occasioned the veto to the general satisfaction of all Parties.

A Party may neither veto decisions relating to its identification to be in breach of its obligations nor to its identification as a Defaulting Party. The Defaulting Party may not veto decisions relating to its participation and termination in the consortium or the consequences of them.

A Party requesting to leave the consortium may not veto decisions relating thereto.

5.2.2.6 Minutes of meetings

The chairperson shall produce minutes of each meeting which shall be the formal record of all decisions taken. The draft minutes shall be sent to all Members within 10 calendar days of the meeting. The minutes shall be considered as accepted if, within 15 calendar days from receipt, no Party has sent an objection to the chairperson with respect to the accuracy of the draft minutes by written notice.

The chairperson shall send the accepted minutes to all the Members, and to the Coordinator, who shall retain copies of them.

5.2.2.7 Decisions of the General Assembly

The General Assembly shall be free to act on its own initiative to formulate proposals and take decisions in accordance with the procedures set out herein.

The following decisions shall be taken by the General Assembly:

Content, finances and intellectual property rights

- Proposals for changes to an individual Grant Agreement where this affects the execution of the Project,
- Changes to the Project Plan, subject to Section 10.4.
- Modifications or withdrawal of Background in Attachment 3 (Background Included)

Evolution of the consortium

- Entry of a new Party to the Project and approval of the settlement on the conditions of the accession of such a new Party which may, as applicable, be subject to consent by the SBEP Call Secretariat and the respective National Funding Agencies
- Withdrawal of a Party from the Project and the approval of the settlement on the conditions of the withdrawal
- Change of the Coordinator, which may be subject to consent by the National Funding Agencies
- Suspension or premature termination of all or Part of the Project, which may be subject to consent by the National Funding Agencies

Breach, defaulting party status and litigation

- Identification of a breach by a Party of its obligations under this CA which may include breach of its obligations under the individual Grant Agreement
- Declaration of a Party to be a Defaulting Party
- Remedies to be performed by a Defaulting Party
- Termination of a Defaulting Party's participation in the consortium and measures relating thereto
- Steps to be taken for litigation purposes and the coverage of litigation costs in case of joint claims of the Parties against a Party (Section 4.2)

In the case of abolished tasks as a result of a decision of the General Assembly, Members shall rearrange the tasks of the Parties concerned. Such rearrangement shall take into consideration any prior legitimate commitments which cannot be cancelled.

5.3 Coordinator

The Coordinator shall be the intermediary between the Parties and shall perform all tasks assigned to it as described in this CA.

The Coordinator is responsible for the daily management of the Project and will oversee co-ordination, execution and delivery of the Project. In particular, the Coordinator shall be responsible for:

- monitoring compliance by the Parties with their obligations under this CA
- keeping the address list of Members and other contact persons updated and available
- informing the General Assembly of any perceived circumstances likely to affect the Project, including but not limited to delays in the execution of work under the Project or a Party becoming insolvent.
- Inform the Sustainable Blue Economy Partnership about any changes in the Project, i.e. modifications of the Project Plan, the consortium, or this CA
- collecting, reviewing to verify consistency and submitting reports, other deliverables and specific requested documents to the respective Parties for further submission to the respective National Funding Agency
- preparing the meetings, proposing decisions and preparing the agenda of General Assembly meetings, chairing the meetings, preparing the minutes of the meetings and monitoring the implementation of decisions taken at meetings
- transmitting promptly documents and information connected with the Project to any other Party concerned
- providing, upon request, the Parties with official copies or originals of documents that are in the sole possession of the Coordinator when such copies or originals are necessary for the Parties to present claims

If one or more of the Parties is late in submission of any Project deliverable, the Coordinator may nevertheless submit the other Parties' Project deliverables and all other documents required on time.

If the Coordinator fails in its coordination tasks, the General Assembly may decide to change the Coordinator.

The Coordinator shall not be entitled to act or to make legally binding declarations on behalf of any other Party or of the consortium, unless explicitly stated otherwise in this CA.

The Coordinator shall not enlarge its role beyond the tasks specified in this CA.

6 Financial provisions

6.1 General Principles

The Project will be executed in accordance with the budget set out in the Project Plan based on funding provided by National Funding Agencies subject to the terms and conditions set out in the respective Grant Agreements.

Each Party shall be solely responsible for the management, reporting, and compliance of its own funding under the respective Grant Agreement. No joint financial management or redistribution of funds shall occur under this CA.

6.2 Financial Independence

Each Party confirms that:

- It has either received, or will receive, funding from its National Funding Agency;
- It will fulfil all financial and administrative obligations as set out in the terms and conditions laid down in such agreement or letter by the relevant National Funding Agency;
- It will not hold other Parties liable for the terms, conditions, or performance of its own Grant Agreement.

6.3 No financial intermediary role of the Coordinator

The Coordinator does not act as a financial intermediary and will not distribute, manage, or report on funding on behalf of the other Parties. The Coordinator's responsibilities are limited to administrative coordination of the Project and communication with the funding authorities where applicable.

6.4 Transparency and cooperation

While there is no shared financial reporting under this CA, each Party agrees to cooperate with the others, in good faith, in compiling non-financial technical progress and impact reports if required by the Joint Call Secretariat, other coordinating bodies or National Funding Agencies. This includes sharing cost-neutral information relevant to project implementation.

6.5 Financial liability

Each Party is solely responsible for any financial claims, repayments, or audits related to its own funding. No Party shall be held financially liable for the non-compliance of another Party with the terms and conditions for funding laid down by its respective National Funding Agency.

6.6 Specific financial commitments

Each Party commits to fulfilling the financial reporting and participation requirements of the Sustainable Blue Economy Partnership, including participation in joint activities, contribution to transnational deliverables, and responsiveness to the Joint Call Secretariat, in accordance with the guidance from their respective National Funding Agency. Financial tracking of in-kind contributions, when applicable, shall be maintained at the national level and made available for transnational coordination if required.

7 Results

7.1 Ownership of Results

Results are owned by the Party that generates them.

7.2 Joint ownership

Where two or more Parties have generated Results jointly, such Results shall be owned jointly by the generating Parties, each in relation to its intellectual contribution to the generation of the relevant Result. Where it is not possible to distinguish each Party's intellectual contribution, the Result shall be owned by the generating Parties in equal shares.

Unless otherwise agreed:

- each of the joint owners shall be entitled to use their jointly owned Results for non-commercial research and teaching activities on a royalty-free basis, and without requiring the prior consent of the other joint owner(s).
- each of the joint owners shall be entitled to otherwise Exploit the jointly owned Results and to grant non-exclusive licenses to third parties (without any right to sub-license), if the other joint owners are given: (a) at least 45 calendar days advance notice; and (b) fair and reasonable compensation.

The joint owners shall agree on all protection measures and the division of related cost in advance.

7.3 Transfer of Results

Each Party may transfer ownership of its own Results, including its share in jointly owned Results provided such transfer does not affect the rights of other Parties under this CA.

A Party intending to transfer ownership must give the other Parties at least 45 days advance written notice together with sufficient information to allow the other Parties to properly assess the extent to which their Access Rights may be affected. A Party may, within 30 days of receiving notification of the intended transfer, object to the transfer by giving written notice to the Party intending to transfer. Such objection shall be justified if the objecting Party can show that the transfer would adversely affect its Access Rights, in which case the transfer may not take place until the Parties concerned reach an agreement with regard to securing future Access Rights for the objecting Party.

The obligations above apply only for as long as other Parties still have - or still may request - Access Rights to the Results.

8 Access Rights

8.1 Background included

In Attachment 3, the Parties have identified and agreed on the Background for the Project and have also, where relevant, informed each other that Access to specific Background is subject to legal restrictions or limits.

All Background shall remain the property of the contributing Party or a third party designated by that Party.

Anything not identified in Attachment 3 shall not be the object of Access Right obligations regarding Background.

Any Party may add additional Background to Attachment 3 during the Project provided they give written notice to the other Parties. However, approval of the General Assembly is needed should a Party wish to modify or withdraw its Background in Attachment 3.

8.2 General Principles

Any Access Rights granted exclude any rights to sublicense unless expressly stated otherwise.

Access Rights are granted on a non-exclusive basis and shall be free of any administrative transfer costs.

Results and Background shall be used only for the purposes for which Access Rights to it have been granted.

All requests for Access Rights shall be made in writing. The granting of Access Rights may be made conditional on the acceptance of specific conditions aimed at ensuring that these rights will be used only for the intended purpose and that appropriate confidentiality obligations are in place.

The requesting Party must show that the Access Rights are Needed.

A Party shall immediately notify relevant Parties and inform the Project Manager if it becomes aware that the use of Background or Results infringes, or may infringe, the intellectual property rights of any Party or third party.

The Parties agree that each Party are responsible to ensure that it will be able to grant the other Parties Access Rights and may transfer ownership to Results in accordance with this CA to any Result generated by its employees or third parties.

8.3 Access Rights for implementation

Access Rights to Results and Background Needed for the performance of the own work of a Party under the Project shall be granted on a royalty-free basis, unless otherwise agreed for Background in Attachment 3.

8.4 Access Rights for Exploitation

8.4.1 Access Rights to Results

Access Rights to Results if Needed for Exploitation of a Party's own Results shall be granted on Fair and Reasonable conditions, including adequate financial conditions to be agreed.

Access rights to Results for non-commercial internal research and for teaching activities shall be granted on a royalty-free basis.

8.4.2 Access Rights to Background

Access Rights to Background if Needed for Exploitation of a Party's own Results, shall be granted on Fair and Reasonable conditions.

8.4.3 Requesting Access Rights

A request for Access Rights may be made up to twelve months after the end of the Project or, in the case of Section 8.6.2.1.2, after the termination of the requesting Party's participation in the Project.

8.5 Additional Access Rights

For the avoidance of doubt any grant of Access Rights not covered by this CA shall be at the absolute discretion of the owning Party and subject to such terms and conditions as may be agreed between the owning and receiving Parties.

8.6 Access Rights for Parties entering or leaving the consortium

8.6.1 New Parties entering the consortium

As regards Results developed before the accession of the new Party, the new Party will be granted Access Rights on the conditions applying for Access Rights to Background.

8.6.2 Parties leaving the consortium

8.6.2.1 Access Rights granted to a leaving Party

8.6.2.1.1 Defaulting Party

Access Rights granted to a Defaulting Party and such Party's right to request Access Rights shall cease immediately upon receipt by the Defaulting Party of the formal notice of the decision of the General Assembly to terminate its participation in the consortium.

8.6.2.1.2 Non-defaulting Party

A non-defaulting Party leaving voluntarily and with the other Parties' consent shall have Access Rights to the Results developed until the date of the termination of its participation.

It may request Access Rights within the period of time specified in Section 8.4.3.

8.6.2.2 Access Rights to be granted by any leaving Party

Any Party leaving the Project shall continue to grant Access Rights pursuant to this CA as if it had remained a Party for the whole duration of the Project.

8.7 Specific Provisions for Access Rights to Software

For the avoidance of doubt, the general provisions for Access Rights provided for in this Section 8 are applicable also to Software.

Parties' Access Rights to Software do not include any right to receive source code or object code ported to a certain hardware platform or any right to receive respective Software documentation in any particular form or detail, but only as available from the Party granting the Access Rights.

9 Dissemination

9.1 General provisions

The Parties agree and understand that all Results from the Project shall be disseminated in accordance with international standards for the publication of research results. All the publications shall be made in adherence to the EC Open Science Policy.

For the avoidance of doubt, the confidentiality obligations set out in Section 10 apply to all dissemination activities described in this Section 9 as far as Confidential Information is involved.

The Parties agree and are aware that National Funding Agencies and the Sustainable Blue Economy Partnership may publicly communicate information provided to them with regard to the Project, whether in the form of reports or otherwise. Thus, no reporting of this kind may contain a Party's Confidential Information.

The Parties shall collectively ensure participation in any conferences or equivalent relevant to the scope of the Project or as may be required by a National Funding Agency and the Sustainable Blue Economy Partnership.

9.2 Dissemination of own (including jointly owned) Results

During the Project and for a period of 1 year after the end of the Project, the dissemination of own Results by one or several Parties including but not restricted to publications and presentations, shall be subject to the following provisions, unless already published.

Prior written notice of any planned Publication shall be given to the other Parties at least 30 calendar days before the submission of the intended Publication. Any objection to the planned Publication shall be made in writing to the Coordinator and to the Party or Parties proposing the Publication within 20 calendar days after receipt of the notice. If no objection is made within the time limit stated above, and if the publishing Party is not aware and reasonably could not have been aware of any infringement of another Party's Confidential Information or intellectual property rights (including but not limited to Background), the Publication is permitted.

Any objection shall include (i) an account of the Confidential Information, Background or Result with regard to which the objection is made, (ii) the grounds for objection, and (iii) a precise suggestion for amendment to the planned Publication whereby the objecting Party deems that its grounds for objection is overcome.

An objection is justified if

- a) the protection of the objecting Party's Results or Background would be adversely affected, or
- b) the objecting Party's legitimate interests in relation to its Results or Background would be significantly harmed, or
- c) the proposed publication includes Confidential Information of the objecting Party.

If an objection has been raised the involved Parties shall discuss how to overcome the justified grounds for the objection on a timely basis (for example by amendment to the planned publication and/or by protecting information before publication) and the objecting Party shall not unreasonably continue the opposition if appropriate measures are taken following the discussion.

The objecting Party may request a Publication delay of not more than 90 calendar days from the time it raises such an objection if needed in order to apply for intellectual property protection before Publication takes place. After 90 calendar days, or such day as the application for protection has been submitted, the publication is permitted, provided that the other objections of the objecting Party have been addressed.

9.3 Dissemination of another Party's unpublished Results or Background

A Party shall not include in any dissemination activity another Party's Results or Background without obtaining the owning Party's prior written approval, unless they are already published.

9.4 Cooperation obligations

The Parties undertake to cooperate to allow the timely submission, examination, Publication and defense of any dissertation or thesis for a degree that includes their Results or Background subject to the confidentiality and publication provisions agreed in this CA.

9.5 Use of names, logos or trademarks

Nothing in this CA shall be construed as conferring rights to use in advertising, publicity or otherwise the name of the Parties or any of their logos or trademarks without their prior written approval. The Parties shall however be entitled to reasonably use each other's names for the purpose of informing about the Project and for reporting on the Project to National Funding Agencies.

For all presentations of the Project, the Parties agree to ensure that any required reference to the funding provided by a National Funding Agency as may be provided for by its respective Grant Agreement, shall be duly observed. Each Party is responsible to keep themselves informed of any such requirements.

10 Non-disclosure of information

10.1 Confidentiality undertaking

The Recipient hereby undertake during the Project and for a subsequent period of 2 years after the end of the Project:

- not to use Confidential Information otherwise than for the purpose for which it was disclosed;
- not to disclose Confidential Information to any third party without the prior written consent by the Disclosing Party;
- to ensure that internal distribution of Confidential Information by a Recipient shall take place on a strict need-to-know basis; and

- to return to the Disclosing Party, or destroy, on request all Confidential Information that has been disclosed to the Recipients including all copies thereof and to delete all information stored in a machine-readable form to the extent practically possible. The Recipients may keep a copy to the extent it is required to keep, archive or store such Confidential Information because of compliance with applicable laws and regulations or for the proof of on-going obligations provided that the Recipient complies with the confidentiality obligations herein contained with respect to such copy.

The Recipient shall apply the same degree of care with regard to the Confidential Information disclosed within the scope of the Project as with its own confidential and/or proprietary information, but in no case less than reasonable care

Each Recipient shall promptly inform the relevant Disclosing Party by written notice of any unauthorised disclosure, misappropriation or misuse of Confidential Information after it becomes aware of such unauthorised disclosure, misappropriation or misuse.

The Recipient shall be responsible for the fulfilment of the above obligations on the part of its employees or third parties involved in the Project and shall ensure that they remain so obliged, as far as legally possible, during and after the end of the Project and/or after the termination of the contractual relationship with the employee or third party.

10.2 Exceptions to confidentiality

The above shall not apply for disclosure or use of Confidential Information, if and in so far as the Recipient can show that:

- the Confidential Information has become or becomes publicly available by means other than a breach of the Recipient's confidentiality obligations;
- the Disclosing Party subsequently informs the Recipient that the Confidential Information is no longer confidential;
- the Confidential Information is communicated to the Recipient without any obligation of confidentiality by a third party who is to the best knowledge of the Recipient in lawful possession thereof and under no obligation of confidentiality to the Disclosing Party;
- the disclosure or communication of the Confidential Information is foreseen by provisions of this CA;
- the Confidential Information, at any time, was developed by the Recipient independently of any such disclosure by the Disclosing Party;
- the Confidential Information was already known to the Recipient prior to disclosure, or
- the Recipient is required to disclose the Confidential Information in order to comply with applicable laws or regulations or with a court or administrative order, subject to the provision hereunder.

If any Recipient becomes aware that it will be required, or is likely to be required, to disclose Confidential Information in order to comply with applicable laws or regulations or with a court or administrative order it shall, to the extent it is lawfully able to do so, prior to any such disclosure notify the Disclosing Party.

11 Miscellaneous

11.1 Attachments, inconsistencies and severability

This CA consists of this core text and

- Attachment 1 (National Funding Agencies)
- Attachment 2 (Project Plan)
- Attachment 3 (Background included)
- Attachment 4 (Accession document)

In case of conflicts between the provisions of the contractual documents, this core text shall prevail, and the Attachments shall thereafter apply in order of enumeration.

Should any provision of this CA become invalid, illegal or unenforceable, it shall not affect the validity of the remaining provisions of this CA. In such a case, the Parties concerned shall be entitled to request that a valid and practicable provision be negotiated that fulfils the purpose of the original provision.

11.2 No representation, partnership or agency

Except as otherwise provided in Section 5.3, no Party shall be entitled to act or to make legally binding declarations on behalf of any other Party or of the consortium. Nothing in this CA shall be deemed to constitute a joint venture, agency, partnership, interest grouping or any other kind of formal business grouping or entity between the Parties.

11.3 Formal and written notices

Any notice to be given under this CA shall be addressed to the recipients as listed in the most current address list kept by the Coordinator.

Any change of persons or contact details shall be immediately communicated to the Coordinator by written notice. The address list shall be accessible to all Parties.

If it is required in this CA that a formal notice, consent or approval shall be given, such notice shall be signed by an authorised representative of a Party and shall either be served personally or sent by mail with recorded delivery with acknowledgement of receipt.

Where written notice is required by this CA, this is fulfilled also by other means of communication such as e-mail with acknowledgement of receipt.

11.4 Assignment and amendments

Except as set out in Section 7.3, no rights or obligations of the Parties arising from this CA may be assigned or transferred, in whole or in part, to any third party without the other Parties' prior formal approval.

Amendments and modifications to the text of this CA not explicitly listed in 5.2.2.7 require a separate written agreement to be signed between all Parties.

The Parties are aware and agree to be bound by any requirement for amendments to the Project Plan to be subject prior information and approval of National Funding Agencies.

11.5 Mandatory national law

Nothing in this CA shall be deemed to require a Party to breach any mandatory statutory law under which the Party is operating.

Each Party is however responsible to ensure, as far as possible, that at the time of signature of this CA, nothing in this CA shall be deemed to require a Party to breach any mandatory statutory law under which the Party is operating. To the extent any future mandatory law forbids or restricts any of the activities contemplated hereunder, the Party concerned agrees to inform the other Parties thereof and cooperate to overcome any consequences thereof.

11.6 Language

This CA is drawn up in English, which language shall govern all documents, notices, meetings, arbitral proceedings and processes relative thereto.

11.7 Applicable law

This CA shall be construed in accordance with and governed by the laws of Sweden excluding its conflict of law provisions.

11.8 Settlement of disputes

The Parties shall endeavour to settle their disputes amicably.

Any dispute, controversy or claim arising under, out of or relating to this contract and any subsequent amendments of this contract, including, without limitation, its formation, validity, binding effect, interpretation, performance, breach or termination, as well as non-contractual claims, shall be submitted to mediation in accordance with the Mediation Rules of the Stockholm Chamber of Commerce Arbitration Institute. The place of mediation shall be Stockholm unless otherwise agreed upon. The language to be used in the mediation shall be English unless otherwise agreed upon.

If one of the disputing Parties objects to mediation or if the mediation is terminated, the dispute shall be finally resolved by arbitration in accordance with the Rules for Expedited Arbitrations of the Stockholm Chamber of Commerce Arbitration Institute. The place of arbitration shall be Stockholm unless otherwise agreed upon. The language to be used in the arbitration shall be English unless otherwise agreed upon.

12 Signatures

AS WITNESS:

The Parties have caused this CA to be duly signed by the undersigned authorised representatives in separate signature pages by qualified electronic signature the day and year first above written.

LULEÅ UNIVERSITY OF TECHNOLOGY

Charlotta Johansson



Head of Department of Civil Environmental and Natural Resources Engineering

Date

Sept 23, 2025

EGE UNIVERSITY

Prof. Dr. İlkin ŞENGÜN

Vice Rector

Date

19.9.2025

SINTEF OCEAN AS



Merete Øverli Moldestad (Oct 1, 2025 08:49:20 GMT+2)

Merete Øverli Moldestad

Deputy CEO

Date 01/10/2025

ELLINIKOS GEORGIKOS ORGANISMOS - DIMITRA

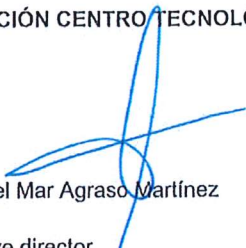
Professor Nektarios Vidakis

First Vice President

Digitally signed by
NEKTARIOS VIDAKIS
Date: 2025-09-24
10:52 EEST

Date

FUNDACIÓN CENTRO TECNOLÓGICO DE ACUICULTURA DE ANDALUCÍA


María del Mar Agraso Martínez

Executive director

Date 19 SEPTIEMBRE 2025


María del Mar Barrios Galán

Executive director

Date 19/SEP/2025


ctaqua
CENTRO TECNOLÓGICO
DE LA ACUICULTURA
CIF: G72094444

INSTITUT NATIONAL DES SCIENCES ET TECHNOLOGIES DE LA MER

Monia EL BOUR

Professor, Coordinator

Date *the 22th of September 2025*



UNIVERSIDADE FEDERAL DE SANTA CATARINA



Documento assinado digitalmente

IRINEU MANOEL DE SOUZA

Data: 24/10/2025 14:57:42-0300

CPF: ***.037.909-**

Verifique as assinaturas em <https://v.ufsc.br>

Irineu Manoel de Souza

University Rector

Date

UNIVERSIDADE FEDERAL DO RIO GRANDE - FURG

Prof. Dr. Suzane da Rocha Vieira Gonçalves

Rector

Date



CIIMAR - CENTRO INTERDISCIPLINAR DE INVESTIGAÇÃO MARINHA E AMBIENTAL

Vitor Vasconcelos

Director

Date 23/09/2025



AALBORG UNIVERSITY



Kim Lambertsen Larsen

Department of Chemistry and Bioscience

Date **30/9-2025**

HALODERMA APS

Henrik Tribler

CEO

A handwritten signature in black ink, consisting of a stylized 'H' followed by a cursive 'T' and a horizontal line.

Date

17/09/25

HALOREFINE APS

Henrik Tribler

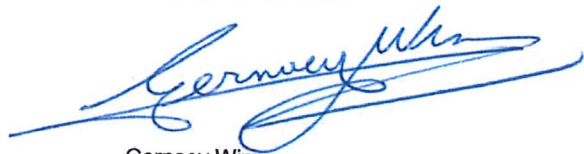


CEO

Date

12/09/25

SOIERIES ELITE N.V.

A handwritten signature in blue ink, appearing to read 'Gernaey Wim', with a long horizontal stroke extending to the right.

Gernaey Wim

Sales and R&D Manager

Date 18/09/2025

Attachment 1: National Funding Agencies

Luleå University of Technology will enter into a National Contract with the Swedish Research Council for Sustainable Development FORMAS (hereafter referred to as "FORMAS") on behalf of the Swedish Party.

Ege University will enter into a National Contract with The Scientific and Technological Research Council of Türkiye (hereafter referred to as "TUBITAK") on behalf of the Turkish Party.

SINTEF Ocean AS will enter into a National Contract with The Research Council of Norway (hereafter referred to as "RCN") on behalf of the Norwegian Party.

Ellinikos Georgikos Organismos will enter into a National Contract with General Secretariat of Research and Innovation (hereafter referred to as "GSRI") on behalf of the Greek Party.

Fundación Centro Tecnológico de Acuicultura de Andalucía will enter into a National Contract with Agencia Estatal de Investigación (hereafter referred to as "AEI") on behalf of the Spanish Party.

Institut National des Sciences et Technologies de la Mer will enter into a National Contract with Direction Générale de la Recherche Scientifique en Tunisie (hereafter referred to as "DGRST") on behalf of the Tunis Party.

Universidade Federal de Santa Catarina and **Universidade Federal do Rio Grande** will enter into a National Contract with Fundação de Amparo à Pesquisa e Inovação do Estado de Santa Catarina (hereafter referred to as "FAPESC") and Fundação de Amparo à Pesquisa do Estado do Rio Grande do Sul (hereafter referred to as "FAPERGS"), respectively, on behalf of the Brazilian Parties.

CIIMAR - Centro Interdisciplinar de Investigação Marinha e Ambiental will enter into a National Contract with Fundação para a Ciência e a Tecnologia, I.P (hereafter referred to as "FCT") on behalf of the Portuguese Party.

Aalborg University and **Haloderma ApS** and **Halorefine ApS** will enter into a National Contract with Innovationsfond Denmark (hereafter referred to as "IFD") on behalf of the Danish Parties.

Soieries Elite N.V. will enter into a National Contract with Vlaamse Overheid Agentschap Inoveren en Ondernemen (hereafter referred to as "VLAIO") on behalf of the Belgian Party.

Attachment 2: Project Plan

1. Project Alignment with Blue Bioresources Priority Area: The sustainable management and utilization of marine bioresources, specifically seaweed and halophytes, present a pivotal opportunity for advancing the blue bioeconomy. These resources, abundant in our oceans and co-existing in coastal and estuarine ecosystems, harbor significant potential for biotechnological applications, contributing to food security, bioenergy production, and the development of novel bio-based products. The ReSEAlience project aligns with the Sustainable Blue Economy Partnership's call to action for innovative approaches to harnessing blue bioresources, addressing both economic growth and environmental sustainability goals. ReSEAlience is designed to directly address the priority area of Blue Bioresources by implementing a universal biorefinery model. This model is geared towards the sustainable extraction and valorization of biomolecules from seaweeds and halophytes, promoting a zero-waste approach and enhancing the resilience of the aquaculture, agri-food, and chemical industries against resource scarcity and environmental challenges. By focusing on these underutilized marine bioresources, the project contributes to diversifying and strengthening the blue bioeconomy's value chains. Through the deployment of the HALOREFINE technique, developed during the H2020 Aquacombine project, ReSEAlience introduces an innovative, solvent-free extraction method tailored for saline biomass. This method ensures the efficient separation of valuable bioactive compounds, mitigating the environmental impact associated with conventional extraction techniques and aligning with the European Green Deal's objectives. Additionally, the project's biorefinery approach leverages organosolv fractionation and enzymatic hydrolysis, followed by employing sustainable bioconversion processes with Black Soldier Fly Larvae (BSFL) and microalgae/thraustochytrids, further exemplifying our commitment to sustainable and eco-friendly resource utilization. ReSEAlience is poised to make a significant contribution to the Blue Economy by demonstrating the commercial viability of seaweed and halophyte biorefineries. This effort is enhanced by the collaborative existence of seaweeds and halophytes alongside aquaculture within Integrated Multi-Trophic Aquaculture (IMTA) systems or through their roles in eutrophication processes, highlighting a synergistic approach to sustainable marine resource management. The project outcomes are expected to lead to new bio-based products, enhance the sustainability of feed and food production, and stimulate economic growth within coastal communities. Furthermore, by sourcing biomass from various sea basins, the project underscores the transnational value of collaborative research and innovation in leveraging Europe's diverse marine ecosystems. Aquaculture has emerged as a key solution, offering nutrient-dense fish, rich in high-quality protein and omega-3 fatty acids. However, the sector's heavy dependence on fishmeal and fish oil sourced from wild pelagic fish places substantial pressure on already stressed marine ecosystems¹.

2. Innovative Approach and Novelty: The ReSEAlience project pioneers a transformative approach in the sustainable valorization of marine bioresources, focusing on seaweed and halophytes. By integrating advanced biorefinery technologies, ReSEAlience goes beyond traditional practices, enhancing efficiency and sustainability, significantly advancing the Blue Economy.

At the heart of ReSEAlience's innovation is the optimization of the HALOREFINE extraction technique, a solvent-free, eco-friendly method exemplifying green chemistry. This process uses water under sub-critical conditions, leveraging thermophysical properties and optimized cascades, including ultrasonic treatment, membrane filtration, and affinity chromatography. HALOREFINE facilitates the extraction of bioactive compounds from *Salicornia* spp., *Ulva* spp., and kelp in stable, highly bioactive forms. Additionally, it co-produces a clean fiber fraction suitable for applications in textiles and bioenergy, aligning with circular economy principles to maximize marine bioresource utility^{2,3}.

The project advances organosolv fractionation for halophytes to create cellulose fibers for textiles or cellulose hydrolysates for bioconversion. By converting halophyte-derived cellulose, ReSEAlience promotes sustainable textile manufacturing and bioconversion systems using substrates for BSFL, microalgae, and marine microorganisms like thraustochytrids⁴. For seaweed, the project employs enzymatic treatments to break down carbohydrates, yielding fermentable sugars for bioconversion into high-value biomass by BSFL and heterotrophic microalgae platforms. This process not only enhances protein and lipid content but can also optimize essential amino acid (EAA) composition for feed⁵. Current feed alternatives, such as plant-based proteins like soy and rapeseed, also have significant environmental drawbacks, resulting in negative severe impact on biodiversity. Feed also contributes to 75-80% of the carbon footprint, underscoring the urgent need for novel and sustainable feed solutions. The project's dedication to sustainability extends into

¹ FAO, "The State of World Fisheries and Aquaculture 2022"; Macusi et al., "Protein Fishmeal Replacement in Aquaculture: A Systematic Review and Implications on Growth and Adoption Viability."

² Hulkko L. et al. Extraction and Quantification of Chlorophylls, Carotenoids, Phenolic Compounds, and Vitamins from Halophyte Biomasses. *Appl. Sci.* **12**, 840 (2022).

³ Hulkko L. et al. Bioactive Extracts from *Salicornia ramosissima* J. Woods Biorefinery as a Source of Ingredients for High-Value Industries. *Plants* **12**, 1251 (2023).

⁴ Monção M et al (2023). A novel biorefinery concept based on marginally used halophyte biomass. *Sustainable Energy & Fuels*, 7(16), 3902-3918

⁵ Patel A et al. (2020). Mining of squalene as a value-added byproduct from DHA producing marine thraustochytrid cultivated on food waste hydrolysate. *Science of the Total Environment*, 736, 13969.

the realm of textiles, where the organosolv fractionation process is refined to transform halophyte-derived cellulose into fibers suitable for textile applications. By optimizing fiber spinning conditions, we aim to produce cellulose fibers with properties comparable to commercial viscose fibers, thereby offering a sustainable alternative to traditional textile fibers. This endeavor not only addresses the increasing demand for cellulose-based materials but also mitigates the environmental footprint associated with conventional textile production^{6,7}. Furthermore, the cultivation and biobanking of seaweed in the Mediterranean, a key component of our project, represent a strategic approach to enhancing the genetic diversity and resilience of marine algae. By selecting strains with superior traits for abiotic stress tolerance and bioactive compound production, we aim to unlock the full potential of seaweed as a sustainable crop. This initiative not only contributes to mitigating coastal eutrophication and climate change but also supports the development of novel food products and industrial applications, thereby bolstering the Blue Economy in the Mediterranean region and beyond⁸. Another key aspect of this innovation is integrating IMTA practices, which embody a sustainable shift from conventional aquaculture by utilizing wastes from one species as resources for another, enhancing system efficiency and reducing environmental impacts⁹. These advancements represent a significant contribution to the Blue Economy, highlighting the ReSEAlence project's role as a frontrunner in the sustainable exploitation of marine bioresources. By enhancing the economic and environmental value of seaweed and halophytes, the project supports the goals of the Green Deal and the Blue Economy, offering innovative solutions to global challenges such as resource sustainability and environmental conservation.

Scientific Objectives:

1. **Validate HALOREFINE Extraction Technique:** Assess the effectiveness and environmental impact of HALOREFINE for extracting bioactive compounds from seaweed and halophytes, comparing it with conventional methods.
2. **Optimize Organosolv pretreatment process:** To optimise the pretreatment process for the efficient fractionation of the extractive-free plant fibres into cellulose, hemicellulose, and lignin, aiming at very low residual lignin in the cellulose fraction (not exceeding 5% lignin content) and an overall cellulose and hemicellulose recovery of >70% after the pretreatment.
3. **Validate BSFL and Microalgae as Bioconversion Systems:** Evaluate BSFL for high-value biomass conversion with ≥40% protein content and assess microalgae and thraustochytrids for functional lipid-rich biomass (≥50% lipid content), using seaweed and halophytes as substrates for high-quality feed, replacing traditional feed ingredients.
4. **Develop Enzymatic Treatments for Seaweeds:** Create enzymatic processes to hydrolyze seaweed carbohydrates, improving at least 70% sugar availability and protein digestibility for enhanced bioconversion into quality feed.
5. **Develop a Scalable Biorefinery Model:** Design a flexible biorefinery model for processing marine bioresources, adaptable to diverse regions, and synergistic with IMTA and eutrophication processes, promoting sustainable aquaculture.
6. **Evaluate Economic and Environmental Sustainability:** Analyze the economic and environmental benefits of biorefinery products and processes to strengthen Europe's sustainable feed production by validating, among the products, two cosmetic extract fractions and developing a marine ingredient-based cosmetic formula.
7. **Support Algae Aquaculture in all evaluated regions:** Provide guidance to foster the sustainable growth of aquaculture in all project regions, ensuring positive social impacts while minimizing environmental harm.
8. **Optimizing Storage for Stable, High-Quality Biomass:** Establish storage and preservation conditions to ensure high-quality raw materials for fractionation, with less than 1% protein and lipid loss and stability for at least two months.

Research Questions:

- How does the HALOREFINE technique compare with traditional extraction methods in terms of efficiency, yield, and environmental impact?
- What are the optimal conditions for organosolv fractionation and the efficiency of enzymatic hydrolysis to maximize the valorization of seaweeds and halophytes within the biorefinery model?
- How effective are BSFL and microalgae/ thraustochytrids as bioconversion systems in enhancing the nutritional value of seaweed and halophytes extractive residues?
- Can the proposed biorefinery model be adapted to different marine bioresources and geographical locations and lead to enhanced farming of halophytes and seaweeds, resulting in benefits within IMTA systems and the mitigation of eutrophication, while also maintaining economic viability and environmental sustainability?

⁶ Theanne N. S et al. (2022). Microbial nanocellulose biotextiles for a circular materials economy. *Environ. Sci.: Adv.*, 2022,1, 276-284.

⁷ Archana Samanta, Oleksandr Nechyporchuk, Romain Bordes (2023). Wet spinning of strong cellulosic fibres with incorporation of phase change material capsules stabilized by cellulose nanocrystals. *Carbohydrate Polymers* Volume 312, 120734.

⁸ Fatima, F et al, 2018. The global status of seaweed production, trade and utilization. *FAO. Globefish Research Programme* Volume 124. Rome, Italy.

⁹ Dunbar M et al (2020). Defining Integrated Multi-Trophic Aquaculture: a consensus. *Aquaculture Europe* 45: 22-27

- What potential markets, beyond feed and food, such as the cosmetic, textile, and chemical industries, exist for bio-based products produced through the seaweed and halophyte biorefinery process, and how can these contribute to the blue bioeconomy?

Through addressing these objectives and questions, ReSEAlence aims to advance our understanding and utilization of marine bioresources, contributing significantly to the sustainable development and resilience of the Blue Economy.

4. Methodology and Synergy: The ReSEAlence project's methodology, organized through interconnected work packages (WPs), presents a holistic approach for sustainably valorizing seaweed and halophytes, with each WP designed to advance the project's ambitious goals through innovation and synergy. **Biomass Management and Conditioning (WP1)** initiates the process, focusing on selecting and conditioning biomass for refinement and valorization. It identifies suitable and representative biomass types, preparing them for subsequent biorefinery stages. **Biorefinery Technologies for Seaweed (WP2)** develops the HALOREFINE extraction process for seaweed, combining it with enzymatic hydrolysis. This innovation produces high-value biomass enriched with proteins and functional lipids through Black Soldier Fly Larvae (BSFL) and marine microorganisms like microalgae and thraustochytrids. **Biorefinery Technologies for Halophytes (WP3)** mirrors WP2's structure for halophytes, using HALOREFINE, organosolv fractionation, and enzymatic hydrolysis to convert halophyte hydrolysates into valuable biomass. This parallel approach emphasizes the project's comprehensive marine bioresource strategy. **Bioproducts Production and Sidestream Valorization (WP4)** focuses on extracting structural polysaccharides like cellulose and alginate from halophytes and seaweed, targeting applications in the textile industry. The WP also valorizes sidestreams, producing biogas and fertilizers from BSFL frass and biogas and hydrochar from halophyte fractions, demonstrating a commitment to circular economy principles. **Bioproducts Analysis and Validation (WP5)** bridges raw biomass and market-ready products, assessing production, purification, and sidestream valorization, reinforcing sustainability goals. **Conceptual Engineering Design and Pilot-Scale Biorefinery Processes Validation (WP6)** tackles scalability challenges through engineering design, computational modeling, and pilot-scale data, ensuring biorefinery innovations can be effectively implemented at scale. **Process Assessment and Feasibility (WP7)** conducts environmental, economic, and social assessments of project processes, guaranteeing sustainable and beneficial outcomes. **IMTA, Aquaculture, and Eutrophication Mitigation (WP8)** integrates biorefinery products into aquaculture systems to boost productivity and sustainability, while mitigating eutrophication, embodying the project's environmental commitment. **Dissemination, Communication & Exploitation (WP9)** maximizes impact through stakeholder engagement, networking, and exploitation planning, ensuring widespread dissemination of project findings. **Project Management (WP10)** oversees coordination, risk management, and data handling, supporting efficient project execution. This structured approach positions ReSEAlence to achieve its vision of sustainable marine biomass utilization, economic growth, and environmental stewardship.

Synergistic Integration Across WPs: The ReSEAlence project's methodology, characterized by its revised WP structure, ensures a seamless flow from biomass management of IMTA systems to market-ready bioproducts and environmental impact assessment. This integrative approach maximizes resource use and expertise across the consortium, allowing for the efficient achievement of project goals and the realization of its potential to significantly advance the blue bioeconomy.

5. Stakeholder Engagement and Societal Impact: The ReSEAlence project embodies a comprehensive approach to stakeholder engagement and societal impact, grounded in the principles of the quadruple helix model. This model emphasizes collaboration among academia, industry, government, and civil society, ensuring that the project's outcomes are socially relevant, economically viable, and environmentally sustainable. For this, ReSEAlence proposes the following Stakeholder Engagement Strategy and some examples of the stakeholders we have contact with (For more details on stakeholders that could be addressed by the consortium, please refer to the participant's details section): (1) **Academia and Research Institutions:** We will engage with leading marine research institutions and universities to exchange knowledge, share best practices, and collaborate on cutting-edge research. This partnership will enhance the scientific rigor of the project and foster innovation in biorefinery technologies and sustainable marine resource management. In academia, we are bolstered by connections with the International Society for Applied Phycology (ISAP) and the EU4Algae Platform from which one of our parents is president and board member, the Spanish Phycological Association (SEF) and the Spanish Technological Platform for Fisheries and Aquaculture (PTEPA). (2) **Industry and Private Sector:** Key industry stakeholders, including biotechnology firms, aquaculture companies, and bio-based product manufacturers, will be involved in the project from its inception. Their insights will guide the development of scalable and market-driven applications for the bioactive compounds and materials derived from seaweed and halophytes. Collaborative pilots and demonstration projects will be implemented to assess commercial viability and support the translation of

research into impactful solutions. Notably, our collaboration extends to the Federation of European Aquaculture Producers (FEAP) and the European Algae Biomass Association (EABA), the Associação Portuguesa de Produtores de Algas, and BIM, the Irish Sea Fisheries Board, enriching our industry engagement. **(3) Government and Policy Makers:** Collaboration with local, national, and EU-level government agencies will ensure that the project aligns with policy objectives for sustainable development, marine conservation, and blue bioeconomy. We will engage in dialogue with policymakers to inform and influence regulatory frameworks and support policies that facilitate the sustainable exploitation of marine bioresources. Our interactions with the Andalusian Agricultural and Fisheries Management Agency (AGAPA), Portugal's Direção-Geral de Política do Mar, Direção-Geral de Recursos Naturais, Segurança e Serviços Marítimos, the Brazilian Society of Aquaculture and Aquatic Biology, and direct work with DG Mare of the European Commission on aquaculture licensing exemplify this engagement. **(4) Civil Society and Community Organizations:** The project will actively involve civil society through partnerships with environmental NGOs, community groups, and educational institutions. **Public engagement activities, including workshops, exhibitions, and participatory science initiatives,** will be co-designed and co-led with local NGOs to ensure community involvement. These initiatives will focus on raising awareness of the importance of sustainable marine resource use and promoting **ocean literacy**. Furthermore, **local communities will be directly involved** in participatory monitoring programs and environmental stewardship efforts. Feedback from these activities will be integrated into the project, ensuring that societal values and concerns are reflected in the research and its applications, highlighted by our collaboration with NGOs such as Ecologistas en Acción. Additionally, ReSEAlence will develop **accessible communication materials** tailored for local communities and NGOs, including simplified reports and educational resources that make project findings and innovations clear and actionable. This ensures that the project's impact reaches all levels of society, fostering an inclusive approach to sustainability and resilience

Societal Impact: **(1) Environmental Sustainability:** By advancing sustainable extraction and valorization techniques, ReSEAlence contributes to the preservation of marine ecosystems and biodiversity. The project's zero-waste approach and focus on circular economy principles will minimize environmental impact and promote the responsible use of marine resources. **(2) Economic Growth and Innovation:** The development of new bio-based products and processes has the potential to stimulate economic growth in coastal regions, create jobs, and foster innovation in the blue bioeconomy sector. By linking scientific research with market needs, ReSEAlence will support the development of competitive and sustainable marine industries. **(3) Social Well-being and Resilience:** The project's outcomes will enhance the resilience of communities dependent on marine resources by diversifying income sources and promoting sustainable practices. Education and outreach activities will enhance public understanding and appreciation of marine ecosystems, contributing to a more informed and engaged society. **(4) Policy Influence and Governance:** Through active engagement with policymakers, ReSEAlence aims to influence marine governance and policy development, advocating for frameworks that support sustainable resource management, innovation, and environmental protection. **(5) Gender Dimensions:** Incorporating gender considerations into the ReSEAlence project is essential for ensuring both **equality and inclusivity** in the sustainable blue economy. Gender dynamics in the aquaculture and bioresource sectors reveal that women are frequently involved in lower-paid, labor-intensive roles, such as harvesting, processing, and marketing, while men tend to dominate technical, managerial, and decision-making positions¹⁰. This disparity in labor roles and access to resources creates barriers to women's full participation and limits their ability to benefit from economic opportunities¹¹. In ReSEAlence, we aim to address these challenges by ensuring equal access to training, resources, and employment opportunities for both men and women. Special attention will be given to bridging the gap in technical and leadership roles, where women are underrepresented. Moreover, gender norms often restrict women's engagement in more lucrative sectors, and this can reduce their influence in decision-making and community leadership, particularly in coastal and agricultural. The project will also assess how gender affects the adoption of new technologies and sustainable practices, ensuring that both men and women are engaged in implementing innovative solutions. By adhering to the European Commission's Gendered Innovations guidelines¹² and promoting inclusive research practices, ReSEAlence will contribute to greater gender equality and help unlock the full potential of **both women and men** in the bioeconomy.

6. Pathways towards Impacts: The Impact Pathway for the ReSEAlence project outlines a strategic progression, aimed at promoting sustainable marine biomass utilization and fostering economic, environmental, and social benefits **based on the Theory of Change Methodology**. Beginning with activities such as cultivation, harvesting, and biorefinery process development, the project operates under the assumption that sustainable practices will not harm ecosystems and that technological innovations are both

¹⁰ FAO, "Advancing towards Gender Equality in Fisheries and Aquaculture"; Kruijsen, McDougall, and van Asseldonk, "Gender and Aquaculture Value Chains: A Review of Key Issues and Implications for Research."

¹¹ Weeratunge, Snyder, and Sze, "Gleaner, Fisher, Trader, Processor: Understanding Gendered Employment in Fisheries and Aquaculture."

¹² "Gender Equality in Research and Innovation - European Commission."

viable and scalable. In the immediate outputs phase, the utilization of black soldier fly larvae (BSFL) and microalgae/thraustochytrids plays a crucial role in transforming seaweed and halophytes into a high-value biomass. Through this process, the biomass becomes rich in protein and functional lipids, making it suitable for high-quality feed production. Additionally, the project focuses on the development of sustainable aquaculture systems integrated with seaweed and halophyte IMTA (Integrated Multi-Trophic Aquaculture) systems. The solids generated from these systems serve as feed for BSFL and as feedstock for the heterotrophic growth of microalgae/thraustochytrids, thereby enhancing nutrient feed profiles and promoting circular economy principles. As the project progresses, short-term outcomes are envisioned to translate into intermediate impacts, characterized by enhanced marine biodiversity, economic diversification, and resilience in coastal communities, as well as improved policy frameworks for marine bioresource management. In the short-term outcomes phase, the project actively engages with regulatory bodies to address the impact of using cultivation systems as a mitigation strategy for eutrophication. This involvement includes navigating regulations related to the implementation of sustainable aquaculture practices and ensuring compliance with environmental standards. Regulatory considerations encompass aspects such as nutrient management, water quality monitoring, and ecological impact assessments. By collaborating with regulatory bodies, the project aims to address potential challenges and ensure that the adoption of cultivation systems contributes positively to eutrophication mitigation efforts while complying with relevant regulations.

Ultimately, these intermediate impacts are projected to culminate in long-term impacts, encompassing environmental, economic, social, and policy dimensions. These long-term impacts include the restoration and preservation of marine ecosystems in the Atlantic Ocean and the Mediterranean Sea, establishment of the regions as leaders in sustainable marine biotechnology, empowerment of coastal communities through active participation in the blue economy, and the development of robust, adaptive policy frameworks supported by evidence-based insights from the project. To support the achievement of these outcomes and impacts, the project employs several supporting strategies, including comprehensive stakeholder engagement activities, a multi-channel communication strategy to disseminate findings and influence policy, and the establishment of a Monitoring, Evaluation, and Learning (MEL) framework to track progress and adapt strategies as needed. Through the systematic implementation of these strategies, ReSEAlence aims to realize its vision of promoting sustainable marine biomass utilization and fostering inclusive economic growth and environmental stewardship in coastal regions.

7. Compliance and Ethical Considerations: The ReSEAlence project is dedicated to integrating compliance and ethics across all R&D activities, with a strong focus on environmental and social responsibility. Adhering to marine environmental regulations, the project ensures that seaweed and halophyte extraction does not harm marine biodiversity or habitats. Ethical protocols guide cultivation practices, including biobanking and genetic selection, to respect natural diversity and protect local marine ecosystems. ReSEAlence aligns with the Nagoya Protocol, ensuring fair sharing of benefits from genetic resources and supporting local communities. Sustainability and responsible marine resource use are prioritized, with ongoing evaluations to uphold high ethical standards, including social impact considerations. Through these measures, ReSEAlence exemplifies responsible innovation in the Blue Economy, fostering stakeholder trust and contributing to sustainable marine biotechnology.

8. Transnational and European Value: The ReSEAlence project exemplifies European and transnational value, driving collaborative innovation within the Blue Economy. By uniting diverse partners, the project harnesses a wide range of expertise to address complex challenges in marine bioresource valorization. This collaborative approach strengthens scientific and technological outcomes while fostering cross-border innovation. Aligned with EU goals like the Green Deal and Blue Growth strategy, ReSEAlence emphasizes sustainable practices and circular economy principles, advancing environmental, economic, and social sustainability. The project highlights how international cooperation can propel a sustainable Blue Economy, providing scalable solutions that strengthen Europe's leadership in marine biotechnology. With partnerships on the coasts of Tunisia, Turkey, and Brazil's Atlantic coast, ReSEAlence expands global collaboration, contributing valuable insights for sustainable marine resource management. Through this cooperative effort, the project promotes a sustainable future for marine environments and communities worldwide.

9. European sea-basins covered by the project: The ReSEAlence project significantly impacts both the Atlantic Ocean and the Mediterranean Sea, including the Aegean Sea, showcasing the versatility and scalability of its innovative biorefinery technologies for sustainable marine resource utilization. In the **Atlantic Ocean**, the project leverages the diverse seaweed resources to develop high-value bioproducts, promoting sustainable economic growth and marine biodiversity conservation. This initiative aligns with the Blue Growth strategy, enhancing the sustainable use of ocean resources and supporting coastal communities in the Atlantic region. Meanwhile, in the **Mediterranean Sea**, ReSEAlence focuses on cultivating and biobanking native seaweed species to address the unique ecological challenges of these sea-basins. The project

contributes to mitigating coastal eutrophication and ocean acidification, fostering sustainable aquaculture practices, and developing novel seaweed-based food products. This effort not only bolsters the region's potential for blue biotechnology innovation but also underscores the importance of sustainable resource management for economic and environmental well-being. Through its targeted interventions in these sea-basins, ReSEAlience enhances Europe's leadership in the Blue Economy, demonstrating the value of integrating scientific innovation with sustainable and responsible marine resource management.

10. Dissemination and Exploitation Plan: Effective stakeholder engagement is crucial for maximizing the impact of the ReSEAlience project. The first step is to clearly identify relevant groups that have a vested interest in the project's outcomes. These stakeholders range from aquaculture industries to policymakers and academic researchers. **A targeted engagement strategy** will ensure that ReSEAlience's innovations are effectively communicated, facilitating collaboration and creating synergies for real-world implementation. This strategy is designed to foster connections between industry, research institutions, and communities, ensuring that the project outcomes drive sustainable practices across sectors. The table below outlines key stakeholder groups, their interests in ReSEAlience, and the core messages that will be communicated to maximize impact.

Table 1: Interest for the identified groups

Target Group	Interest in ReSEAlience	Core Message
Aquaculture & Agri-Food Industries	Sustainable and efficient biorefinery processes for seaweed and halophyte biomass, improving production and environmental performance.	ReSEAlience enhances sustainability and economic efficiency in resource use, contributing to resilient food production systems.
Policymakers & Regulatory Authorities	Access to data supporting sustainable marine resource management and regulatory compliance.	ReSEAlience provides evidence for policy frameworks that promote environmental responsibility and resource efficiency.
Scientific & Research Communities	Advancement in marine biotechnology and biorefinery processes, with open-access scientific results available for further research.	ReSEAlience delivers innovative biorefinery techniques that support cutting-edge research and industrial applications.
Local Communities & Coastal Stakeholders	Improved environmental quality and economic opportunities through sustainable marine resource use.	ReSEAlience promotes sustainable resource use that benefits both local ecosystems and community livelihoods.
General Public & Environmental NGOs	Reduction of environmental impact through the sustainable exploitation of marine bioresources.	ReSEAlience contributes to environmental sustainability and supports climate action through responsible resource management.

Beyond stakeholder engagement, **dissemination actions** will be aligned with the needs of different target audiences. ReSEAlience will implement a range of dissemination activities, ensuring knowledge transfer and widespread communication of project results. These actions will promote the adoption of biorefinery technologies and support broader sustainability goals in the blue bioeconomy. The table below summarizes the planned dissemination activities, their target groups, and the metrics for measuring success.

Table 2: Summary of dissemination action of ReSEAlience project and outcomes

Dissemination Actions	Target Audience	Metrics
Peer-reviewed publications in journals like <i>Marine Drugs</i> , <i>Journal of Applied Phycology</i> , <i>Bioresource Technology</i> .	Scientific & Academic Community	10 open-access publications by the project's conclusion.
Presentations at industry forums (e.g., BioMarine Business Convention, European Algae Industry Summit).	Industry & Business	Participation in at least 3 major industry conferences.
Webinars to share innovations in biorefinery technologies with industry and policymakers.	Industry, Policymakers	2 webinars organized to engage stakeholders in knowledge transfer.
Public outreach materials for local communities and environmental NGOs explaining the project's impacts.	General Public, NGOs	Creation of accessible communication materials annually.
Specialized training programs for students and early-career researchers in sustainable marine resource management.	Students, Academia	2 educational training sessions conducted over the course of the project.
Policy briefs & reports summarizing findings for	Policymakers	2 policy briefs produced by

regulatory bodies to inform policy development.		the project's conclusion.
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Among the diverse possibilities of the ReSEAlience project, some Key Exploitable Results (KERs) that will be obtained include CTAQUA's optimized seeding methods for macroalgae, sustainable harvesting protocols for halophytes in IMTA systems, and innovative fish diets enriched with seaweed and halophytes to boost aquaculture growth. DIMITRA will provide a specialized Ulva cultivation protocol for eutrophic waters, aiding coastal lagoon biomass. LTU will implement an organosolv process for halophytes and enzymes for seaweed hydrolysis, advancing marine biorefineries. SINTEF and HALOREFINE will deliver fractionation and hydrolysis technologies, creating high-value, stable products for cosmetics, textiles, and chemicals, while HALODERMA will obtain novel functional cosmetic ingredients and products formulations that could be directly commercialized in the market.

11. Work plan and resources

Task	Year 1												Year 2												Year 3													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36		
WP1: Biomass Management and Conditioning																																						
Task 1.1: Collection and Analysis of Biomass						D									♦D																							
Task 1.2: Biomass Conditioning for Processing						♦																		D														
WP2: Biorefinery Technologies For Seaweed																																						
Task 2.1 Halorefine Extraction Technique Implementation																		D						♦						D								
Task 2.2 : Enzymatic Hydrolysis of Seaweed																		♦D						♦						D								
Task 2.3 Conversion of Seaweed Hydrolysates to High-Value Biomass																														D							D	
WP3: Biorefinery Technologies For Halophytes																																						
Task 3.1: Halorefine Extraction of Halophyte Bioactives																		♦D																				
Task 3.2: Organosolv Fractionation of Halophyte Fibers																									♦						♦	D						
Task 3.3: Conversion of Hydrolyzed Halophyte Cellulose to High-Value Biomass																															♦D						D	
WP4: Bioproducts Production and Sidestreams Valorization																																						
Task 4.1 Feed Formulation and Feeding Trials with Fish																			♦																		D	
Task 4.2 Fish Feeding Challenge Test with Bacterial Pathogen																																					D	
Task 4.3 Side-Streams Valorization															♦															D		♦D		♦D				
WP5: Bioproducts Analysis and Validation																																						
Task 5.1: Bioproducts Analysis																																					D	
Task 5.2: Bioproducts Validation for Multiple Applications																																					D	
Task 5.3: Development and Validation of Functional Fish Diets																																					D	
WP6: Conceptual Engineering Design and Pilot-Scale Biorefinery ...																																						
Task 6.1: Conceptual design and engineering																									♦D													
Task 6.2: Conceptual up-scaling validation																																						
Task 6.3: Scalability and Integration Feasibility Studies																																					♦	
WP7: Process Assessment and Feasibility																																						
Task 7.1 Life Cycle Assessment																										D											D	
Task 7.2 Life Cycle Costing, Economic Feasibility, and Circular ...																										D											D	
Task 7.3 Environmental Impact Evaluation of IMTA Systems																																						
Task 7.4 Do No Significant Harm (DNSH) Analysis																																						
Task 7.5: Regulatory Assessment																																					D	
WP8: IMTA, Aquaculture, and Eutrophication Mitigation																																						
Task 8.1: Development and Optimization of IMTA Systems																																					D	
Task 8.2: Productivity and Sustainability Assessment of IMTA Systems																																					D	
Task 8.3: Eutrophication Mitigation Monitoring and Measurement																																					D	
Task 8.4: Fish Health Assessment																																					D	
WP9: Dissemination, Communication & Exploitation																																						
Task 9.1 Communication and dissemination activities						♦D																																
Task 9.2 Stakeholder identification and engagement																																					D	
Task 9.3 Exploitation plan																																					D	
Task 9.4 Clustering and networking activities																																					D	
WP10: Project Management																																						
Task 10.1: Project Coordination				D																																		
Task 10.2: Administrative and Financial Management				D																																		
Task 10.3: Risk Management							D					D																									D	
Task 10.4: Research Data Management							D																			D											D	

Figure 1: Gantt Chart of the ReSEAlience project

ReSEAlience adopts a structured approach with well-defined work packages (WPs) and tasks that streamline workflow from biomass collection to bioproduct analysis and validation. Each WP builds upon the previous ones, forming an interconnected framework for collaborative goal achievement. Complementary tasks within each WP underscore a strategy that blends scientific research, technological innovation, and practical applications to meet project objectives. Interdependencies among WPs enhance resource optimization and knowledge transfer. WP1 initiates the project by collecting, analyzing, and conditioning biomass, forming the foundation for WPs 2 and 3. These WPs apply biorefinery technologies to process seaweed and halophytes, extracting bioactive compounds and generating valuable biomass. Outputs from WPs 2 and 3 support WP4, where bioproducts are developed, and sidestreams valorized. This cascading model establishes a clear input-output structure for each WP, facilitating cohesive process flow and minimizing redundancy. Collaboration is integral, with WP2 and WP3 involving AAU, HALOREFINE, LTU, and ENORM in optimizing biorefinery technologies. WP4 sees CIIMAR and LTU working on diet formulation and sidestream valorization, aligning research outputs across WPs. Such partnerships foster shared expertise and resources, enhancing innovation and potential outcomes. The Gantt chart provides a clear timeline, aligning tasks across WPs. Milestones and deliverables are spaced to allow steady progress and flexibility. WP6, focused on engineering design and pilot-scale validation, ensures scale-up activities benefit from prior R&D insights. WP7 assesses environmental and economic impacts, supporting long-term viability. Effective communication and dissemination occur through WP9, ensuring that project results reach relevant stakeholders. WP10

emphasizes project management, streamlining coordination, risk management, and data handling, allowing technical teams to focus on their contributions without administrative delays.

Table 3: Work Package description

WP No.	1
WP Title	Biomass Management and Conditioning (SINTEF)
Objectives - Identify and analyze the availability, chemical composition, and suitability of selected seaweeds and halophytes for targeted applications. - Develop and optimize biomass preservation and conditioning methods to maintain quality and extend usability for subsequent project phases. Provide sufficient quantities of stabilized biomass for use in downstream work packages, ensuring consistent quality and applicability.	
Task 1.1: Collection and Analysis of Biomass Subtask 1.1.1 Seaweeds and Halophytes Collection in Spain (CTAQUA): CTAQUA will collect various seaweeds and halophytes, including <i>Salicornia</i> and <i>Sarcocornia</i> species, from earthen pond IMTA systems and experimental fish wastewater ponds. Target species such as <i>Valonia</i> spp., <i>Ulva ohnoi</i> , <i>Gracilaria</i> spp., and <i>Chondracanthus teedei</i> will be analyzed for proximate composition (carbohydrates, lipids, protein, ash) and heavy metals across seasons. The biomass will be passed to other work packages for further analysis. Subtask 1.1.2 Seaweed Analysis in Sweden (LTU): LTU will work with <i>Saccharina latissima</i> , <i>Ulva fenestrata</i> , and <i>Palmaria palmata</i> , supplied by Nordic SeaFarm. Using a modified two-step acid hydrolysis, LTU will quantify sugars via HPLC and determine protein content with the Kjeldahl or Dumas method. Subtask 1.1.3 Biomass Survey and Characterization in Brazil (UFSC, FURG): UFSC will survey algae producers in Brazil's Santa Catarina, assessing production sites for environmental quality and nutrient removal. Biomass from <i>Kappaphycus alvarezii</i> , <i>Ulva</i> spp., <i>Sargassum</i> spp., and other algae blooms will be collected, with tasks including processing samples for European submission, local analysis, and generating productivity equations. FURG will analyze <i>Salicornia neei</i> from various IMTA setups for nutritional and bioactive phenolic content. Subtask 1.1.4 Collection and Biochemical Characterization in Turkey and Tunisia (EGE, INSTM): EGE and INSTM will collect <i>Ulva lactuca</i> , <i>U. rigida</i> , <i>U. linza</i> , <i>Gracilaria gracilis</i> , <i>Petalonia fascia</i> , and halophytes <i>Salicornia fragilis</i> and <i>S. europaea</i> from Izmir Bay, Turkey. Samples will be analyzed for carbon, nitrogen, phosphorus, and metals. Environmental parameters (temperature, oxygen, salinity, and nutrients) will be measured, and biomass densities per square meter will be calculated. Task 1.2 Biomass Conditioning for Processing (SINTEF, CTAQUA, LTU, UFSC): To maintain biomass quality for extended periods, SINTEF, CTAQUA, LTU, and UFSC will evaluate preservation techniques such as super-chilling, drying, and salt/pH adjustments. CTAQUA will develop protocols for initial processing, optimizing methods for energy use, space efficiency, and scalability. Methods will include freshwater washing, solar drying, oven drying, freeze-drying, and freezing, assessing their impacts on compound integrity and biomass quality.	
WP No.	2
WP Title	Biorefinery Technologies For Seaweed (AAU)
Objectives - Optimize extraction and fractionation processes to obtain high-yield bioactive compounds from seaweed for various applications. - Scale up extraction techniques to produce stable and concentrated bioactive ingredients suitable for product development. - Convert seaweed hydrolysates into nutrient-rich biomass using BSFL and marine microorganisms for high-value products.	
Description of work Task 2.1 Halorefine Extraction Technique Implementation (AAU, HALOREFINE) Subtask 2.1.1 Optimization and Validation of Bioactive Extraction: AAU will develop and validate the Halorefine extraction method (patent PA 2024 70008) for bioactive compounds from <i>Saccharina latissima</i> , <i>Ulva fenestrata</i> , and <i>Palmaria palmata</i> . This method utilizes a cascade of natural, biomass-derived solvents and biocatalysts to enhance extraction yields of polyphenols and pigments. Key extraction parameters, such as temperature, residence time, and biomass-solvent ratios, will be optimized to maximize bioactivity (antioxidant, anti-inflammatory, and antimicrobial effects) while minimizing energy input. Membrane and resin adsorption methods will be used for isolating bioactive compounds, and optimization will be guided by the design of experiments (DoE). Subtask 2.1.2 Scale-up of Cascade Extraction (HALOREFINE): The optimized extraction process will be scaled up to a 5 kg/h flow rate in HALOREFINE's 100 L demonstration facility, originally developed under Horizon 2020's AQUACOMBINE project. Produced bioactive fractions will be purified and stabilized,	

then provided to WP4 and WP5 for product development, with residual biomass supplied for further processing in Tasks 2.2 and 2.3.

Task 2.2 Enzymatic Hydrolysis of Seaweed (LTU)

Subtask 2.2.1 Novel Enzyme Production and Characterization: LTU will identify and produce novel enzymes, such as alginate and ulvan lyases, for breaking down seaweed carbohydrates. Using enzyme mining, these enzymes will be expressed in microbial hosts, purified, and characterized for activity on model substrates to ensure specificity and efficiency.

Subtask 2.2.2 Design of Hydrolysis Treatment: The selected enzymes will be used in sequential and one-pot treatments in a specially designed reactor. Hydrolysis will be performed under high dry-matter conditions to produce enriched seaweed hydrolysates, with further treatment using cellulase and protease blends. These hydrolysates will be analyzed to determine composition and suitability for downstream applications.

Task 2.3 Conversion of Seaweed Hydrolysates to High-Value Biomass (ENORM, LTU)

Subtask 2.3.1 Optimization of BSFL Conversion Using Hydrolyzed Seaweeds: ENORM will test BSFL conversion of hydrolyzed seaweed, analyzing metrics like biomass conversion, larval survival, and nutrient composition (amino acids, fatty acids). Optimal hydrolysate levels will be tested with co-substrates (e.g., halophyte cellulose, food waste) to develop an industrial-scale process.

Subtask 2.3.2 Optimization of Marine Microorganisms for Omega-3 Production: Thraustochytrids and microalgae, previously optimized by LTU, will be cultivated using seaweed hydrolysates under heterotrophic conditions to maximize omega-3 fatty acid yields. Key growth factors like C/N ratio, pH, and temperature will be optimized for this substrate. The resulting biomass will be analyzed for lipid and protein content, essential amino acids, and antioxidant potential using the INFOGEST 2.0 digestion model.

WP No.	3
WP Title	Biorefinery Technologies For Halophytes (LTU)

Objectives

- Develop efficient extraction and fractionation processes for bioactive compounds from green and brown halophyte biomass.
- Enhance cellulose purity and yield from halophytes for downstream applications through optimized organosolv pretreatment.
- Convert hydrolyzed halophyte cellulose into high-value biomass using BSFL and marine microorganisms to maximize protein and omega-3 outputs.

Description of work

Task 3.1 Halorefine Extraction of Halophyte Bioactives (AAU, HALOREFINE)

Subtask 3.1.1 Optimization of Bioactive Extraction from Halophytes: Halophyte biomass will be extracted at different growth stages: green (partially lignified) and brown (fully lignified). Using Halorefine technique, bioactive compounds specific to each biomass state will be targeted, following the extraction approach in Task 2.1. Extraction parameters will be optimized to yield high levels of antioxidant, anti-inflammatory, and antimicrobial compounds.

Subtask 3.1.2 Scale-up of Extraction Process (HALOREFINE): The optimized extraction process will be scaled up to 5 kg/h at HALOREFINE's demonstration plant to produce bioactive fractions from green and brown halophytes. These fractions will be processed and delivered to WP4 and WP5 for further applications.

Task 3.2 Organosolv Fractionation of Halophyte Fibers (LTU): Halophyte fibers from Task 3.1 will undergo organosolv pretreatment to enhance cellulose yield and purity, optimizing ethanol concentration, temperature, and catalyst type using LTU's multidigester system. A two-step mild bleaching will further refine cellulose. The resulting cellulose, hemicellulose, and lignin fractions will be analyzed, with purified cellulose sent to WP4 for textiles, hemicellulose for biogas, and lignin for hydrochar. Solvent recovery systems will reclaim and reuse solvents to minimize waste and optimize the process's environmental footprint.

Task 3.4 Conversion of Hydrolyzed Halophyte Cellulose to High-Value Biomass (ENORM, LTU)

Subtask 3.4.1 Optimization of BSFL Conversion Using Hydrolyzed Halophyte Cellulose (ENORM): This task will assess the conversion efficiency of BSFL using hydrolyzed halophyte cellulose. Parameters such as larval survival, growth, and nutrient profile will be optimized. Co-substrates (e.g., brewery grains, food waste) will be tested for improved conversion rates, followed by large-scale trials to evaluate industrial viability.

Subtask 3.4.2 Optimization of Marine Microorganism Conversion Using Hydrolyzed Halophyte Cellulose (LTU): Thraustochytrids and microalgae will be cultivated on hydrolyzed halophyte cellulose to maximize omega-3 production. Key parameters like nutrient concentration, pH, and C/N ratio will be optimized, based on previous studies. Resulting biomass will be analyzed for lipid and protein yield, and

nutrient profiles will be assessed for animal feed potential.	
WP No.	4
WP Title	Bioproducts Production and Sidestreams Valorization (CIIMAR)
Objectives • Formulate and evaluate diets with selected bioproducts to enhance growth and health of European seabass juveniles. • Assess the best diets for improving disease resistance in seabass against <i>Tenacibaculum maritimum</i>. • Valorize side-streams like BSFL frass and lignin by producing biogas and hydrochar.	
Description of work Task 4.1 Feed Formulation and Feeding Trials with Fish (CIIMAR): CIIMAR will create experimental diets for European seabass juveniles, incorporating bioproducts from WP2 (2–5%) and WP3 (0.1–0.5%), tailored to seabass nutritional needs. Two 4–6-week feeding trials will evaluate the diets' effects on growth and health, with triplicate setups under standard conditions. Metrics will include growth, feed efficiency, blood haematology, immune parameters in skin mucus and plasma, gut gene expression and microbiome, and liver antioxidant responses (catalase, glutathione). Task 4.2 Fish Feeding Challenge Test with Bacterial Pathogen (CIIMAR): The diets with the most positive health and immunity effects will be selected for pathogen challenge tests. European seabass will consume these diets for 4–6 weeks before exposure to <i>Tenacibaculum maritimum</i>. Mortality rates and causes will be tracked over two weeks. Pre- and post-infection samples of blood, plasma, liver, and head kidney will assess immune responses. Skin mucus and tissue samples will undergo proteomic and RNA sequencing, and gut samples will be analyzed for microbiome composition. Task 4.3 Side-Streams Valorization (LTU, ENORM) Subtask 4.3.1 Valorization of BSFL Frass and Hemicellulose for Biogas Production: BSFL frass and hemicellulose will be analyzed for solids, volatile solids, pH, and C/N ratio. Biogas potential will be tested in 2L reactors using AMPTS under optimized conditions. Subtask 4.3.1 Process Intensification and Biogas Upgradation for Hydrogen-Enriched Methane: Biohydrogen and biomethane production will be enhanced by enriching inoculum with shocks to suppress archaea and optimizing inoculum-to-substrate ratios. Recirculated CO₂ and H₂ will be converted to acetate, boosting methane content and biogas fuel value. Subtask 4.3.2 Production of Hydrochar from Halophyte Lignin and Digestate: Hydrothermal carbonization (HTC) will convert digestate or lignin (30% dry matter) into hydrochar at 200–250 °C for two hours, then dried at 105 °C. The hydrochar's properties will be analyzed via SEM, FTIR, XRD, and TGA.	
WP No.	5
WP Title	Bioproducts Analysis and Validation (HALODERMA)
Objectives • Advance Salicornia-derived cellulose yarn production through the research and development of innovative natural dyeing and finishing methods, aligning with sustainable practices for potential industrial scaling. • Assess and validate the potential of biomass fractions for cosmetic applications	
Task 5.1 Bioproducts Analysis (ENORM, CIIMAR, HALODERMA): HALODERMA will analyze functional fractions of halophyte and seaweed biomass—such as extracts and oils—to assess their potential in cosmetics. This includes quantifying bioactive compounds like phenolics, flavonoids, and tannins through absorption spectroscopy, evaluating antioxidant capacity, and testing radical scavenging activity. Additionally, in vitro tyrosinase inhibition assays will be conducted, as tyrosinase is linked to skin hyperpigmentation. Fatty acid profiles in oils will be assessed for their role in supporting skin moisture and barrier function. CIIMAR will focus on analyzing bioproducts from seaweed and halophytes, specifically targeting extracted proteins, functional lipids, and structural polysaccharides such as cellulose and alginate. These components will be evaluated for their nutritional profiles, bioactivity, and digestibility to determine their effectiveness in aquaculture feeds, aiming to promote fish health and growth. ENORM will examine biogas and side-stream products from BSFL frass and hemicellulose, focusing on their stability and scalability to assess their industrial potential across broader applications. Task 5.2 Bioproducts Validation for Multiple Applications (SE, HOGENT, HALODERMA): Subtask 5.2.1 Bioproducts for cosmetic applications: Promising biomass fractions will be validated by HALODERMA for cosmetic applications through formulation trials. Based on their active properties, the optimal product types—such as a facial serum or cream—will be selected. Toxicological assessments will ensure safety and proper use of novel ingredients. Subtask 5.2.1 Textile Bioproducts Validation and Yarn Production: SE and HOGENT will validate biomass fractions for textiles by producing yarn from recycled fibers. Twisting processes will create various yarn types suitable for applications like fancy yarns, knitting, and braiding. The yarn's properties will be	

evaluated for suitability in final textile products.

Subtask 5.2.2 Characterization of Yarn Properties: SE will characterize the new fiber to ensure quality and performance standards. This includes measuring the metric number (dtex) for linear density, assessing twists per meter influencing strength and texture, and evaluating tensile strength for durability. These assessments support the fiber's development and potential applications.

Task 5.3 Development and Validation of Functional Fish Diets (CTAQUA): CTAQUA will develop up to five fish diets with project-derived seaweed and halophyte biomass, analyzing for proximate composition, amino acids, and fatty acids. Nutritional properties will be tested against a commercial diet in 12-week seabream or seabass trials, monitoring growth rate, feed intake, feed conversion, and survival. Fish will be reared in controlled recirculating systems, with daily checks on oxygen, salinity, and welfare. Blood, kidney, and skin mucus samples will assess immune responses, and fillets will be analyzed for nutritional composition.

WP No.	6
WP Title	Conceptual Engineering Design and Pilot-Scale Biorefinery Processes Validation (HALOREFINE)

Objectives

- Ensure the feasibility and scalability of the biorefinery model for large-scale implementation through optimized process conditions.
- Maximize efficiency and minimize costs using computational simulations, mathematical modeling, and thermodynamic analyses.
- Support large-scale integration by refining the biorefinery model with robust optimization tools.

Description of work

Task 6.1 Conceptual design and engineering (SINTEF, HALOREFINE): Develop conceptual engineering designs for the biorefinery processes through process flow diagrams (PFD), and process instrumentation diagrams (PID), and optimize mass and heat/energy balances using existing process analyses.

Task 6.2 Conceptual up-scaling validation (SINTEF, HALOREFINE): Data regarding scalability of the cascaded HALOREFINE process described in WP2 and WP3 will be generated through pilot-scale (100 L extraction) results.

Task 6.3 Scalability and Integration Feasibility Studies (SINTEF, HALOREFINE): Ensure the biorefinery model's feasibility, scalability, and practical application for large-scale integration and implementation through thorough optimization of the process conditions, minimizing and maximizing objective functions using computational simulations (SuperPro Designer), mathematical modelling (mixed integer non-linear programming), and thermodynamical analyses (Heat Exchanger Network Design – Pinch Analysis).

WP No.	7
WP Title	Process Assessment and Feasibility (EGE)

Objectives

- Assess environmental sustainability of key processes using Life Cycle Assessment (LCA).
- Evaluate economic feasibility of the biorefinery model through Life Cycle Costing (LCC).
- Measure environmental impact of IMTA systems to enhance resource sustainability.

Description of Work

Task 7.1 Life Cycle Assessment (EGE): A comprehensive LCA will be performed to evaluate the main environmental sustainability indicators of the project's key processes, including the biorefinery model for seaweed and halophytes. The assessment will address critical hotspots such as energy consumption, greenhouse gas (GHG) emissions, and resource efficiency, supporting EU Taxonomy compliance.

Task 7.2 Life Cycle Costing, Economic Feasibility, and Circular Economy Considerations (EGE): An extensive LCC analysis will be performed to assess the economic sustainability of the biorefinery model, prioritizing cost-efficiency and market potential of bio-based products derived from seaweed and halophytes. Insights gained from the LCC will inform the economic feasibility study and circular economy considerations. This evaluation will explore potential circularity by examining waste valorization pathways, side-stream utilization, and the role of IMTA systems in enhancing sustainability.

Task 7.3 Environmental Impact Evaluation of IMTA Systems (EGE): A specific evaluation of the Integrated Multi-Trophic Aquaculture (IMTA) systems will be carried out to measure their environmental benefits, such as nutrient cycling, waste reduction, and the mitigation of eutrophication. This assessment will ensure that the integration of IMTA systems contributes positively to ecosystem resilience and resource sustainability.

Task 7.4 Do No Significant Harm (DNSH) Analysis (ISOTECH): A theoretical DNSH analysis will be conducted to assess potential risks associated with substances identified in the raw materials, products, by-products, side streams, and waste streams used in the project (relevant information and data to be provided by project partners & Tasks 7.1. & 7.2, as necessary). This evaluation will ensure compliance with

EU DNSH criteria by identifying any substances that may impact human health, biodiversity, or ecosystems, and providing recommendations for mitigation.

Task 7.5: Regulatory Assessment (ISOTECH): The relevant policy framework (national and EU) related to the implementation of sustainable aquaculture practices will be analyzed to determine relevant policy barriers and opportunities. Analysis will be undertaken through desk-based work and the implementation of a policy roundtable. Relevant policy stakeholders will be engaged through dialogue to inform and influence regulatory frameworks and support policies that facilitate the sustainable exploitation of marine bioresources. Policy conclusions and recommendations will be shared through policy briefings and a policy conference.

WP No.	8
WP Title	IMTA, Aquaculture, and Eutrophication Mitigation (CTAQUA)

Objectives

WP8 Objectives:

- Develop and optimize IMTA systems to maximize sustainable biomass production of seaweeds, halophytes, and marine species.
- Assess the productivity, nutrient assimilation, and environmental sustainability of IMTA systems to support nutrient cycling and eutrophication mitigation.
- Evaluate the health benefits of IMTA-produced feed components on fish health and overall aquaculture system efficiency.

Description of work

Task 8.1 Development and Optimization of IMTA Systems (EGE, DIMITRA, CTAQUA, INSTM, FURG)

This task focuses on developing on-land and earthen pond IMTA systems, assessing annual production potential for various seaweed and halophyte species in different setups. Trials will be conducted using recirculating water systems in outdoor tanks and raceways, as well as IMTA seaweed production in extensive aquaculture ponds. Seaweed growth will be monitored across different seasons, and physiological states will be assessed via PAM fluorescence to optimize photosynthetic efficiency. For sporulating seaweed species, lab-controlled trials will test longline seeding on materials like polypropylene and hemp under varied light and temperature conditions. Halophytes will be produced from seed germination and vegetative propagules in hydroponic benches, floating rafts and soil beds lined with geomembranes, which will be integrated with the other components of the evaluated IMTA systems. Water quality parameters, such as nutrient and salinity levels, will be regularly measured, while sustainable harvesting techniques will be developed for halophytes. Algae and halophytes will be analyzed for nutrient content to support nutrient budget models.

Subtask 8.1.1 Environmental Characterization: An in-depth environmental assessment of the cultivation sites will be conducted, characterizing ecosystems for IMTA compatibility. This includes analyzing local water quality, nutrient levels, and potential seasonal impacts on biomass productivity.

Task 8.2 Productivity and Sustainability Assessment of IMTA Systems (EGE, DIMITRA, CTAQUA, INSTM, FURG): This task will compile productivity data on IMTA components—seaweeds, halophytes, and marine species—to quantify nutrient assimilation rates and evaluate sustainability. This includes assessing nitrogen and phosphorus uptake by plants and animals, as well as the carbon fixation and global warming mitigation potential of the IMTA systems. Production data will be provided to facilitate comprehensive productivity and environmental impact assessments.

Task 8.3 Eutrophication Mitigation Monitoring and Measurement (EGE, DIMITRA, CTAQUA, INSTM, FURG, CIIMAR, UFSC): Data from Task 8.1 will support estimating nutrient uptake potential, with models developed to assess eutrophication mitigation capacity in upscaled IMTA systems. Monthly water quality monitoring will be conducted, focusing on nutrient assimilation, salinity, temperature, and other critical indicators. Seasonal phenotyping of seaweed and halophyte photosynthetic traits will help clarify nutrient removal efficiency under varying conditions. Additional methods, including Algal Turf Scrubbers and microalgal remediation systems, will enhance biomass production and nutrient removal efficiency.

Task 8.4 Fish Health Assessment (CIIMAR): At the end of each trial, fish health will be assessed by collecting blood, plasma, and skin mucus samples for immune parameter evaluation, along with gut and liver tissues for gene expression and antioxidant analysis. This will provide insights into the health benefits of feed components produced in IMTA systems.

WP No.	9
WP Title	Dissemination, Communication & Exploitation (ISOTECH)

Objectives

- To develop the strategy that will be followed throughout the project to communicate and disseminate key project information and share and exploit project results.
- To identify relevant channels and implement actions to ensure that the project's work and outputs are

effectively disseminated to key stakeholders.

- To develop and implement the exploitation strategy of the project and its Key Exploitable Results.
- To develop links and synergies with other EU projects and initiatives.

Description of work

Task 9.1 Communication and dissemination activities (ISOTECH, All): A Communication and Dissemination Strategy and Plan (CDP) will be developed at the beginning of the project and continuously monitored and updated to ensure the project maximises its outreach to and impact on wider society and targeted audiences. Specific KPIs will be developed and regularly monitored (every 6 months) to ensure the CDP's effectiveness. Communication and dissemination resources will be developed (e.g. templates, presentations etc), and a project website and social media accounts will be set up and continuously updated. All partners will contribute to the project's communication and dissemination activities.

Task 9.2 Stakeholder identification and engagement (ISOTECH, All): This task will coordinate the stakeholder identification and the stakeholder engagement activities of the project to ensure that knowledge and project outputs are effectively and efficiently transferred. It is closely linked with Task 9.1 and Task 9.3. The main target audiences for the project's knowledge transfer activities are (i) academia through publications and conference participation, (ii) industry and potential end-users through targeted communications, participation in SBEP joint events, participation at fairs and exhibitions, and a final industry brokerage event, (iii) NGOs and civil society through targeted communication and dissemination activities, and participation at open-day events, and (iv) policy-makers through policy briefings and the policy roundtable.

Task 9.3 Task 9.3 Exploitation plan development (ISOTECH, All): Partners will define business models and exploitation plans for their Key Exploitable Results. Two internal workshops, facilitated by ISOTECH, will be implemented back-to-back with in-person project meetings, to discuss the structure, main elements and potential format of the pathways for exploitation and IPR management, to ensure they are comprehensive and robust.

Task 9.4 Clustering and networking activities (ISOTECH, DIMITRA): This task will connect the project and its outputs with the main EU strategies, Missions and existing relevant initiatives and projects through information exchange, joint initiatives and cross-invitation to events/activities. Synergies and opportunities for collaboration will be identified where relevant, to maximize the project's impact.

WP No.	10
WP Title	Project Management (LTU)

Objectives

- Ensure efficient coordination of all project tasks and partners for seamless execution.
- Provide comprehensive administrative and financial oversight, ensuring compliance and timely reporting.
- Identify and mitigate potential risks to maintain project stability and performance.
- Implement secure and effective research data management, ensuring data integrity and accessibility.

Description of work

The project management team will organize and coordinate all aspects of the project to streamline operations, ensure compliance with the Contract and Consortium Agreements, and promote smooth collaboration among partners.

Task 10.1 Project Coordination: This task focuses on establishing the organizational structure of the project, including necessary operational bodies. Regular meetings and progress reviews will be held to align partners and monitor advancements. Project coordination will ensure that work packages are in sync, that deliverables meet quality expectations, and that any issues are addressed promptly. Strategic outreach to relevant stakeholders and management of intellectual property rights (IPR) will also be included.

Task 10.2 Administrative and Financial Management: Administrative support will cover legal, logistical, and financial aspects of the project. This includes the preparation of standard reports, consolidation of cost statements, and coordination of payments. A collaborative platform will be set up to facilitate communication, documentation, and financial reporting across the consortium, providing partners with secure access to project updates and archives.

Task 10.3 Risk Management: Continuous risk assessment will be performed, identifying potential technological, financial, or operational risks. Corrective actions will be implemented as needed to mitigate these risks and minimize project disruptions. Each project meeting will review risk and mitigation measures, updating strategies as necessary to maintain project continuity and performance.

Task 10.4 Research Data Management: Research data will be managed in compliance with data management protocols. This includes secure storage, access management, and adherence to ethical and legal guidelines. Data will be made accessible for internal project use and for external stakeholders as appropriate, ensuring data integrity and protection throughout the project lifecycle.

Table 4: List of deliverables (R: Report, P: Public, SEN: Sensitive, CON: Confidential)

#	Deliverable name	Short description	WP	Leader	Type	Dis.	Date
1.1	Biomass Analysis Report	Comprehensive analysis of seaweed carbohydrates and proteins.	1	LTU	R	SEN	M6
1.2	Biomass Selection Overview	Overview of sampled species, composition, selection criteria.	1	SINTEF	R	SEN	M15
1.3	Biomass Conditioning Methods	Comparison of conditioning methods and upscaling potential.	1	CTAQUA	R	SEN	M24
1.4	Stabilized Biomass Supply	Delivery of stabilized biomass for further project tasks.	1	CTAQUA	R	SEN	M24
2.1	Seaweed Composition Report	Chemical composition of targeted seaweeds.	2	AAU	R	SEN	M18
2.2	Enzymatic Activity Report	Novel enzymatic activities for seaweed polysaccharides.	2	LTU	R	CON	M18
2.3	Extraction Optimization Report	Optimized extraction cascades for bioactives.	2	AAU	R	CON	M30
2.4	Sugar Release Report	Sequential treatment for sugar release from seaweed.	2	LTU	R	CON	M30
2.5	Bioactive Stabilization Methods	Report on stabilization and isolation of bioactives.	2	HALOREFINE	R	SEN	M36
2.6	Functional Ingredients Scale-up	Scale-up production of functional ingredients.	2	ENORM	R	CON	M36
3.1	Halophyte Composition Report	Chemical composition of green and brown halophyte biomass.	3	AAU	R	SEN	M18
3.2	Halophyte Extraction Report	Optimized extraction cascade for halophytes.	3	AAU	R	SEN	M30
3.3	Organosolv Fractionation Report	Fractionation parameters and yields for cellulose, hemicellulose, and lignin.	3	LTU	R	CON	M31
3.4	Microorganism Conversion Optimization	Efficiency report on marine microorganism conversion.	3	ENORM	R	CON	M36
3.5	Bioactive Isolation Methods	Stabilization and isolation of bioactive compounds from halophytes.	3	HALOREFINE	R	SEN	M36
3.6	Halophyte Ingredient Scale-up	Scale-up report for functional halophyte ingredients.	3	ENORM	R	CON	M36
4.1	Homoacetogenic Culture Development	Development and optimization of an enriched culture for biogas.	4	LTU	R	CON	M28
4.2	Biogas Production Analysis	Production and analysis of high-purity biogas.	4	LTU	R	SEN	M30
4.3	Hydrochar Development Report	Characterization of hydrochar from halophytes and digestate.	4	LTU	R	SEN	M32
4.4	Fish Feeding Trials Report	Results of fish feeding trials with functional diets.	4	CIIMAR	R	P	M36
4.5	Fish Challenge Test Report	Results of fish health tests with functional diets under pathogen challenge.	4	CIIMAR	R	P	M36
5.1	Cosmetic Formulation Trials	Bioactivity assessment and formulation for cosmetics.	5	HALODERMA	R	CON	M36
5.2	Aquafeed Bioproducts Validation	Evaluation of bioproducts in aquafeeds, diet composition, and fish performance.	5	CTAQUA	R	SEN	M36
5.3	Yarn Production and Validation	Report on yarn production and validation for textile applications.	5	SE	R	SEN	M30
5.4	Yarn Characterization	Characterization of yarn properties, including density and tensile strength.	5	SE	R	CON	M36
6.1	Design and Engineering Report	Design of PIDs and PFDs for the HALOREFINE process.	6	HALOREFINE	R	SEN	M24
6.2	Up-scaling Validation Report	Mass and energy balance optimization for HALOREFINE process.	6	HALOREFINE	R	SEN	M30

6.3	Feasibility and Scalability Report	Feasibility and scalability of the biorefinery model.	6	HALOR EFINE	R	SEN	M36
7.1	Preliminary LCA/LCC Assessment	Initial Life Cycle Assessment and Costing analysis.	7	EGE	R	CON	M24
7.2	Final LCA/LCC and IMTA Assessment	Final LCA, LCC, DNSH, IMTA environmental assessment and Regulatory assessment.	7	EGE	R	CON	M36
8.1	IMTA Production Report	Biomass production of selected species in IMTA systems.	8	CTAQU A	R	SEN	M30
8.2	Aquaculture Sustainability Assessment	Productivity and sustainability of aquaculture systems.	8	EGE	R	SEN	M36
8.3	Eutrophication Mitigation Report	Nutrient data analysis demonstrating mitigation potential.	8	CTAQU A	R	SEN	M36
9.1	Communication and Dissemination Plan	Strategy and plan for project communication and dissemination.	9	ISOTEC H	R	P	M6
9.2	Stakeholder Engagement Impact	Report on the impact of stakeholder engagement activities.	9	ISOTEC H	R	P	M36
9.3	Exploitation and IPR Plans	Report on exploitation, IPR, and business strategies.	9	ISOTEC H	R	CON	M36
9.4	Clustering and Networking Activities	Report on project clustering and networking activities.	9	ISOTEC H	R	SEN	M36
10.1	Project Collaborative Platform	Report on the setup and functionality of the project's online platform for management and communication.	10	LTU	R	P	M3
10.2	Project Management Plan	Report on the project's structure, roles, and coordination processes.	10	LTU	R	P	M3
10.3	Data Management Plan	Report on data handling, storage, and sharing practices, ensuring compliance with standards.	10	LTU	R	P	M6, M24, M36
10.4	Quality Assurance Plan	Report on quality control measures for monitoring deliverables and project performance.	10	LTU	R	P	M3
10.5	Risk and Mitigation Reviews	Periodic reports on project risks and mitigation strategies.	10	LTU	R	P	M6, M12, M18, M24, M30, M36

Table 5: List of milestones

#	Milestone name	WP	Date	Means of verification
1.1	First Biomass Delivered to WP2	1	M6	Shipment documentation
1.2	Seaweed Species Selection Completed	1	M15	D1.1
2.1	Five Novel Enzymatic Activities	2	M18	Report on enzyme activities for polysaccharides
2.2	Extraction Cascade Screening Completed	2	M24	Screening report
2.3	First Bioactive Production Run	2	M24	Demo plant production records
2.4	Sequential Treatment Yield >85%	2	M30	Yield report on sugar release
3.1	Cellulose, Hemicellulose, and Lignin Delivered	3	M18	Delivery records
3.2	Halophyte Extraction Screening Complete	3	M24	Screening report
3.3	First Halophyte Bioactive Production	3	M24	Production records
3.4	Optimized Omega-3 & Amino Acids Biomass	3	M30	Biomass analysis
4.1	Bioproducts Sent to CIIMAR	4	M14	Shipment records
4.2	Start of Feeding Trials	4	M18	Trial start report
4.3	Enriched Homoacetogenic Culture	4	M28	Culture verification report
4.4	High-Purity Biogas (>95% CH ₄)	4	M30	Biogas composition report
4.5	Hydrochar Characterization Completed	4	M32	Hydrochar properties report
5.1	Cosmetic Properties Screening	5	M30	Screening report
5.2	Final Aquafeed Formulation	5	M30	Diet formulation sheets
6.1	Conceptual Design of HALOREFINE Facility	6	M24	D6.1

6.2	Validated Process Conditions	6	M36	D6.2 and D6.3
7.1	IMTA Environmental Impact Completed	7	M30	Presentation and inclusion in D7.2
9.1	Project Website & Social Media Launch	9	M6	Website live and first social media posts

Table 6: Critical risks for implementation

Risk Description	WP	L	S	Proposed risk-mitigation Strategy
Technical risk				
Inconsistent biomass quality due to seasonal variations	1	M	H	Standardize sampling and quality checks; adjust conditioning seasonally.
High contamination levels in biomass affecting usability	1	L	M	Conduct site assessments and apply pre-treatment (e.g., washing) to reduce contaminants.
Low enzyme hydrolysis efficiency for bioconversions	2	M	H	Apply mild acid hydrothermal pretreatment to increase saccharification.
Toxic metal accumulation in seaweed impacting hydrolysis and safety	2	L	H	Use pre-approved seaweed species; apply EDTA or ultrasound treatment to reduce metals; test final biomass for metal content.
Inefficiency in halophyte extraction processes	3	M	H	Optimize extraction parameters based on lab testing; adjust extraction conditions as needed.
Excessive solvent use in extraction, increasing costs	3	M	M	Implement solvent recovery and adjust solvent-to-biomass ratios.
Low biogas yield from BSFL frass and hemicellulose	4	L	M	Optimize reactor conditions and substrate ratios to improve yield.
Low hydrochar quality affecting applications	4	M	M	Adjust hydrothermal carbonization conditions for improved quality.
Bioproducts fail to meet cosmetic standards	5	L	M	Perform early cosmetic property assessments; adjust formulations to ensure compliance.
Insufficient textile fiber quality from halophyte sources	5	M	M	Blend with high-quality fibers and apply additional processing to improve textile properties.
Non-linear scaling issues affecting cost and energy projections	6	M	H	Use staged scaling with pilot data; apply sensitivity analysis to correct early inefficiencies.
Incomplete data for LCA affects assessment accuracy	7	M	M	Use proxy data and scenario models; validate results as more data is available.
Low nutrient removal efficiency in IMTA systems	8	L	H	Optimize species composition and stocking density; adjust water management practices.
Health issues in fish due to novel feed components	8	M	M	Conduct preliminary health tests with small doses, increasing gradually based on fish responses.
External, Organizational and Management Risk				
Patent, trademark or any IPR infringement during the project	9	L	H	A preliminary patent search was done at proposal stage, and Task 9.4 will monitor patents throughout the project.
IPR conflicts among partners	9	L	H	The partner's IP background will be outlined in the Consortium Agreement, while the IP strategy will be established in Task 9.4. Ownership of KERs will be defined within the PDEC.
Withdrawal of a partner	all	L	H	Tasks of the leaving partner will be reallocated within the consortium or new partners will be added to the consortium.
Project staff leave during project	all	M	M	Data and protocols will be well documented to facilitate handover.
Poor project management	10	L	H	An experienced Project Management Team will manage the project; robust procedures, milestones and risk management are defined.
Failure to achieve deliverables	all	L	H	Regular follow-up of deliverables in WP, EMB and GA meetings; possible deviations taken to the EMB and GA for resolution.
Conflicts within the consortium	all	L	M	The partners will follow the agreed conflict resolution procedures.

Attachment 3: Background included

PARTY 1: LTU

As to LTU, it is agreed between the Parties that, to the best of their knowledge, the following Background is hereby identified and agreed upon for the Project. Specific limitations and/or conditions, shall be as mentioned hereunder:

Describe Background	Specific restrictions and/or conditions for implementation of the Project	Specific restrictions and/or conditions for Exploitation of Results
LTU has established expertise, capacities, and know-how in the field of halophyte biorefineries, documented through peer-reviewed publications, as well as in heterotrophic microalgal cultivation using lignocellulosic hydrolysates. LTU has developed scientific and technical approaches related to bioprocess design, biomass pretreatment and fractionation, enzymatic saccharification, microbial fermentations, and integrated biorefinery concepts for sustainable production of feed ingredients, functional lipids, and biomaterials.	For the implementation of the Project, LTU will deliver scientific and technical information, data, and know-how, as well as access to infrastructure and proprietary methodologies related to: • halophyte and seaweed processing and valorisation routes (pretreatments, saccharification, fermentations) • heterotrophic growth of microalgae and thraustochytrids on lignocellulosic hydrolysates, • biorefinery integration for feed, and material applications. LTU grants Access Rights to its Background as Needed within the Consortium to fulfil the obligations under the Project. Such Access Rights shall be non-exclusive, non-transferable, non-sub-licensable, and shall remain in effect only for the duration of the Project. Access shall be granted on a royalty-free basis and limited strictly to the scope of the Project.	Access to LTU's Background for exploitation of Results will require LTU's prior written consent and shall be defined in a separate agreement. If LTU's Background is used in generating any Result, LTU shall be duly acknowledged, included in the corresponding Intellectual Property Rights (IPR) considerations, and reflected in the exploitation plan. The use of LTU's Background must also be acknowledged in any Communication, Dissemination, or Exploitation activity undertaken by the Parties.

This represents the status at the time of signature of this CA.

PARTY 2: EGE

As to EGE, it is agreed between the Parties that, to the best of their knowledge, no data, know-how or information of EGE is Needed by another Party for implementation of the Project or Exploitation of that other Party's Results, This represents the status at the time of signature of this CA.

PARTY 3: SINTEF

As to SINTEF, it is agreed between the Parties that, to the best of their knowledge, the following Background is hereby identified and agreed upon for the Project. Specific limitations and/or conditions, shall be as mentioned hereunder:

Describe Background	Specific restrictions and/or conditions for implementation of the Project	Specific restrictions and/or conditions for Exploitation of Results
Hardware: "Mobile Sealab", a mobile processing lab owned by SINTEF Ocean	Access rights during execution of project work and access to project results (data and products)	Financial terms apply, as agreed during budgeting of lab rental costs for SINTEF's work package.

This represents the status at the time of signature of this CA.

PARTY 4: DIMITRA

As to DIMITRA, it is agreed between the Parties that, to the best of their knowledge, no data, know-how or information of DIMITRA is Needed by another Party for implementation of the Project or Exploitation of that other Party's Results. This represents the status at the time of signature of this CA.

PARTY 5: CTAQUA

As to FUNDACION CENTRO TECNOLOGICO ACUICULTURA DE ANDALUCIA (CTAQUA), it is agreed between the Parties that, to the best of their knowledge, the following Background is hereby identified and agreed upon for the Project. Specific limitations and/or conditions, shall be as mentioned hereunder:

Describe Background	Specific restrictions and/or conditions for implementation of the Project	Specific restrictions and/or conditions for Exploitation of Results
Copyright, know-how and trade secrets in Seaweed hatchery techniques and outgrowing	Access to other Beneficiaires only when necessary for implementing the Action	Access to other Beneficiaires only under fair and reasonable conditions to results needed for exploiting their results

Copyright, know-how and trade secrets in use and evaluation of seaweeds and/or their extracts animal feed applications	Access to other Beneficiaires only when necessary for implementing the Action	Access to other Beneficiaires only under fair and reasonable conditions to results needed for exploiting their results
Copyright, know-how and trade secrets in production process through extrusion of animal feed applications	Access to other Beneficiaires only when necessary for implementing the Action	Access to other Beneficiaires only under fair and reasonable conditions to results needed for exploiting their results

This represents the status at the time of signature of this CA.

PARTY 6: INSTM,

As to INSTITUT NATIONAL DES SCIENCES ET TECHNOLOGIES DE LA MER, it is agreed between the Parties that, to the best of their knowledge, the following Background is hereby identified and agreed upon for the Project. Specific limitations and/or conditions, shall be as mentioned hereunder:

Describe Background	Specific restrictions and/or conditions for implementation of the Project	Specific restrictions and/or conditions for Exploitation of Results
Copyright, know-how and trade secrets in Seaweed hatchery and micro epibionts techniques and outgrowing	Access to other Beneficiaires only when necessary for implementing the Action	Access to other Beneficiaires only under fair and reasonable conditions to results needed for exploiting their results
Copyright, know-how and trade secrets in use and evaluation of seaweeds and/or their micro epibionts and extracts animal feed applications	Access to other Beneficiaires only when necessary for implementing the Action	Access to other Beneficiaires only under fair and reasonable conditions to results needed for exploiting their findings.
Copyright, know-how and trade secrets in use and evaluation of seaweeds their micro epibionts and/or their extracts animal feed applications	Access to other Beneficiaires only when necessary for implementing the Action	Access to other Beneficiaires only under fair and reasonable conditions to results needed for exploiting their results

This represents the status at the time of signature of this CA.

PARTY 7: UFSC

As to UFSC, it is agreed between the Parties that, to the best of their knowledge, no data, know-how or information of UFSC is Needed by another Party for implementation of the Project or Exploitation of that other Party's Results.

This represents the status at the time of signature of this CA.

PARTY 8: FURG

As to FURG, it is agreed between the Parties that, to the best of their knowledge, the following Background is hereby identified and agreed upon for the Project. Specific limitations and/or conditions, shall be as mentioned hereunder:

Describe Background	Specific restrictions and/or conditions for implementation of the Project	Specific restrictions and/or conditions for Exploitation of Results
Copyright, know-how and trade secrets in halophyte cultivation techniques and Integrated Multi-Trophic Aquaculture (IMTA) systems	Access to other Beneficiaires only when necessary for implementing the Action	Access to other Beneficiaires only under fair and reasonable conditions to results needed for exploiting their results
Copyright, know-how and trade secrets in use and evaluation of halophyte and/or their extracts animal feed and health applications	Access to other Beneficiaires only when necessary for implementing the Action	Access to other Beneficiaires only under fair and reasonable conditions to results needed for exploiting their results

This represents the status at the time of signature of this CA.

PARTY 9: CIIMAR

As to CENTRO INTERDISCIPLINAR DE INVESTIGAÇÃO MARINHA E AMBIENTAL (CIIMAR), it is agreed between the Parties that, to the best of their knowledge, the following Background is hereby identified and agreed upon for the Project. Specific limitations and/or conditions, shall be as mentioned hereunder:

Describe Background	Specific restrictions and/or conditions for implementation of the Project	Specific restrictions and/or conditions for Exploitation of Results
CIIMAR has wide experience, capacities and know-how for the design, optimisation and implementation of R&D&I solutions, as well as in the development of scientific and technical approaches related to feed formulation, fish performance, health, infectious models, biomarkers, immunomodulation and immunostimulation. For the implementation of the Project, CIIMAR will deliver scientific and technical information, data and know-how, infrastructure and proprietary assets related to: • feed formulations, including formulation with alternative ingredients, and their consequences on fish performance and health; infection models with virulent bacterial strains; feeding with immunomodulatory and immunostimulant compounds in fish; biomarkers of health condition in the European seabass.	CIIMAR grants Access Rights to the Background as Needed within the Consortium to fulfil the obligations under the Project. Such Access Rights shall not be assignable or exclusive and shall not be subject to sub-licensing. Access to Background is limited to the duration of the Project and shall be granted on a royalty-free basis. No use of CIIMAR's Background is permitted outside of the scope of Project.	Access to CIIMAR's Background for exploitation of Results will be subject to CIIMAR's authorisation and cannot be granted without prior consent. Such Access Rights shall be agreed upon in a specific agreement. Should CIIMAR's Background be used in any Result, CIIMAR shall be included in all relevant Intellectual Property Rights (IPR) considerations and duly reflected in the corresponding exploitation plan. The use of CIIMAR's Background shall be acknowledged in any Communication, Dissemination and Exploitation activity carried out by the Parties.

This represents the status at the time of signature of this CA.

PARTY 10: AAU

As to AALBORG UNIVERSITET, it is agreed between the Parties that, to the best of their knowledge, no data, know-how or information of AAU is Needed by another Party for implementation of the Project or Exploitation of that other Party's Results, This represents the status at the time of signature of this CA.

PARTY 11: HALODERMA

As to HALODERMA, it is agreed between the Parties that, to the best of their knowledge, no data, know-how or information of HALODERMA is Needed by another Party for implementation of the Project or Exploitation of that other Party's Results. This represents the status at the time of signature of this CA.

PARTY 12: HALOREFINE

As to HALOREFINE, it is agreed between the Parties that, to the best of their knowledge, no data, know-how or information of HALOREFINE is Needed by another Party for implementation of the Project or Exploitation of that other Party's Results.

This represents the status at the time of signature of this CA.

PARTY 13: SE

As to SE, it is agreed between the Parties that, to the best of their knowledge, no data, know-how or information of SE is Needed by another Party for implementation of the Project or Exploitation of that other Party's Results. This represents the status at the time of signature of this CA.

Attachment 4: Accession document

ACCESSION

of a new Party to

[Acronym of the Project] Consortium Agreement, version [..., YYYY-MM-DD]

[OFFICIAL NAME OF THE NEW PARTY AS IDENTIFIED IN THE relevant Grant Agreement]

hereby consents to become a Party to the Consortium Agreement identified above and accepts all the rights and obligations of a Party starting [date].

[OFFICIAL NAME OF THE COORDINATOR AS IDENTIFIED IN THE CONSORTIUM AGREEMENT]

hereby certifies that the consortium has accepted in the meeting held on [date] the accession of [the name of the new Party] to the consortium starting [date].

This Accession document has been done in 2 originals to be duly signed by the undersigned authorised representatives.

[Date and Place]

[INSERT NAME OF THE NEW PARTY]

Signature(s)

Name(s)

Title(s)

[Date and Place]

[INSERT NAME OF THE COORDINATOR]

Signature(s)

Name(s)

Title(s)